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# Electrical World

*The consolidation of Electrical World, Electrical Engineer and American Electrician*

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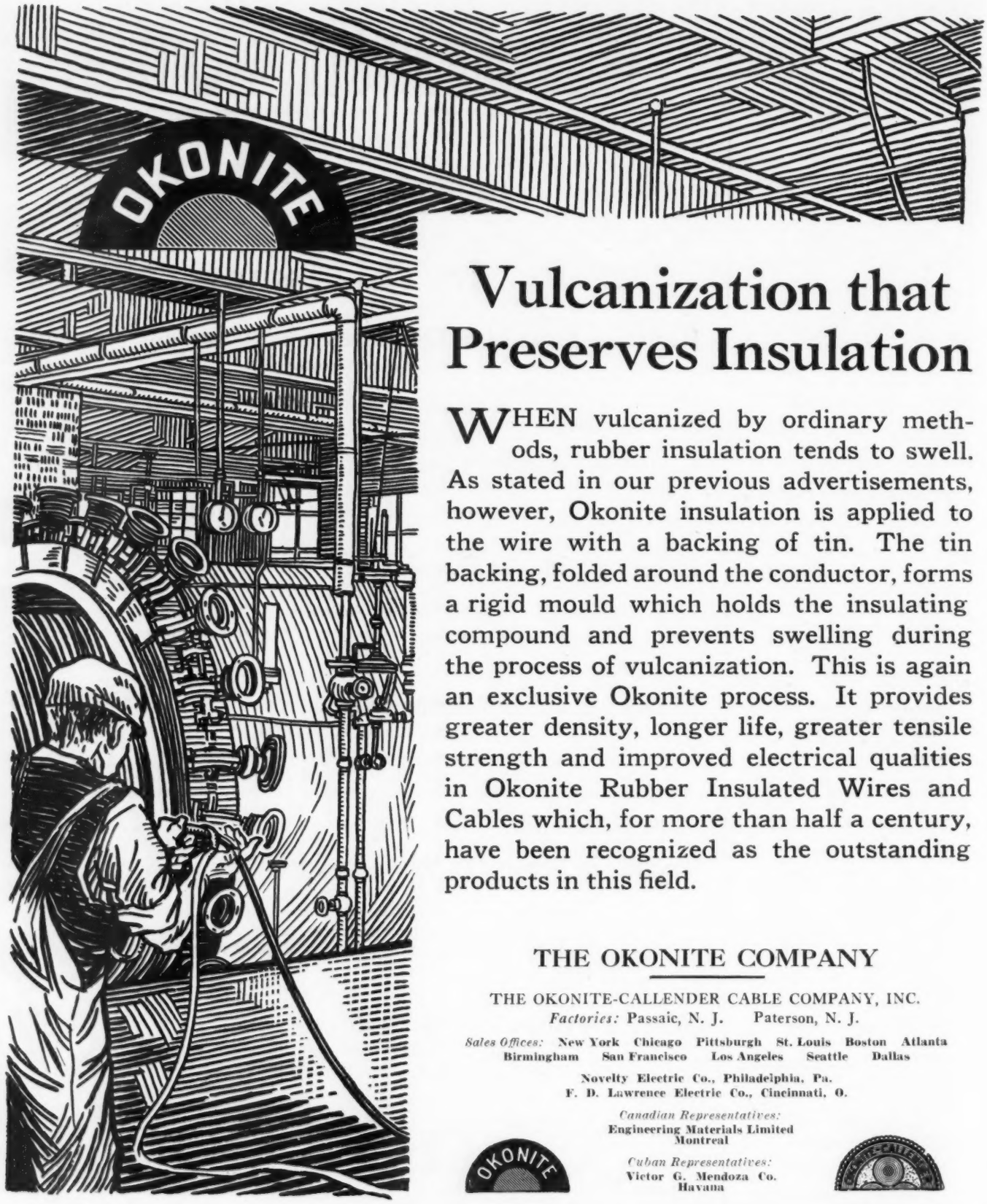


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# Electrical World

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## *Expansion and Public Ownership*

SOME very vague financial conceptions exist about the utility business. Many do not realize that the capital required to give service in an expanding business increases at a very rapid rate and will amount to an enormous sum in a few years. Experience shows that a property investment of five dollars per dollar of gross revenue is an average industry figure and that the gross revenue will grow indefinitely at about 8 per cent per year. This means, for example, that a property with $14,800,000 gross revenue in 1928 will require a total added investment of $730,000,000 during the following thirty years. The unit figures will vary, but those chosen are typical of utility financial requirements.

A utility is not like a house that is bought for a certain figure, depreciated at a certain rate and can be resold at a market price. The utility must grow indefinitely, because service demands grow indefinitely; it cannot be depreciated readily, because of the vast assembly of varied equipment and because of the peculiarities of a rapidly changing business and art, and its sales price is fixed largely by earnings and the operating ratio instead of by the investment in physical plant.

Proponents of government or municipal ownership do not know these facts. They do not realize that the initial bond issue to start the utility business must be followed by others and still others, each compounded in magnitude as the years elapse. Such clauses as those that permit recapture at cost after a twenty-, thirty- or fifty-year period are nonsensical in most cases. So much capital is involved that the community and the taxpayers would find it entirely impracticable to exercise their privilege under the optional clause. It should be made known that a light and power enterprise takes capital and more capital and that this condition will continue indefinitely at a rate of expansion greater than the normal rate of growth for municipal credit. This is the fact that should be faced by taxpayers when they are approached with municipal ownership proposals.

* * * *

## *"Power Trust" and Newspapers*

MUCH adoo has been made about the purchase of newspapers by the International Paper & Power Company. Claims are made that the "power trust" has set out to control the press and, under senatorial pressure, the Federal Trade Commission is immediately set to work to find the facts. Even the American Newspaper Publishers' Association was brought under pressure to condemn the International company, but these newspaper men had wisdom enough to say, "This incident is a matter of private business and does not concern us."

It is obvious that the purchase of newspaper securities by the International was to establish a welcome and a market for its newsprint paper. This procedure, from the business point of view, follows the trend in many branches of industry, and it is only because this company is in the power business as well as the paper business that there is cause for senatorial concern. The reason the company has entered the power field lies largely in the fact that it has moved its paper production to the Canadian woods and that the New England water powers it owns and formerly used for paper production now offer business opportunities as power producers for utility purposes.

From both the "good business" and the policy points of view no utility should undertake side lines of business. There is sufficient opportunity in the utility field for a great business development and every utility company should lean backward in an attempt to keep to the business for which it is organized. There is little doubt that the International Paper & Power Company acted in good faith in its newsprint sales development program, but a careful consideration of the utility situation at this time and of the broad policy under which utilities should be developed leads to the conclusion that this company should divorce its newspaper business from its power business. At the same time, this incident should not be magnified. It was not an act of the light and power industry as a whole, and it may be taken for granted that the newspaper purchases were not made with any idea of controlling the press in mind. These facts undoubtedly will be brought out in the Federal Trade Commission hearings.

* * * *

## *Hewers of Wood Versus Trail Makers*

SOON a new crop of electrical engineering graduates will be harvested from the field of technical education. No small part of their usefulness will depend upon their mental attitude toward the organizations in which they will find employment, toward the problems which they will participate in solving and toward the apparent limitations which will surround them. These young men will enter practice with minds trained to study deeply into causes and effects, well grounded in principles and for the most part eager to prove their mettle. As they accumulate experience the handicap of conforming to established practices will gradually tend to increase their conservatism, and in some cases originality will in time give way to placid acceptance of things as they are. Thus will be formed a residue, so to speak, of useful hewers

of wood and drawers of water necessary to the routine operations of industry and business. Others will submit to established customs sufficiently to work in phase with those who have preceded them into the field, but mentally they will refuse to acknowledge limitations as permanent, and in time they will create new methods and practices which will advance the progress of applied science into new fields of achievement. Conformity in their cases will make stepping stones to higher levels.

The importance of keeping a wide-open mind in engineering cannot be exaggerated. What is good for the new graduate is wholesome for many older workers in the industry. The deadening influence of familiarity resulting from long exposure to existing conditions is often overlooked. The existence of a main line of physical or mental transit across a particular area for many years tends to obliterate immediate thought of reaching objectives by other and perhaps shorter routes. Here the young engineering graduate should take warning, and the alert experienced worker no less. The questioning point of view is vital to further advance, and magnificent as is the development of the electrical industry in this year 1929, finality is nowhere in sight. Without offense to superiors it is entirely within the realm of practicability to acquire this habit of mind, keeping counsel until the time is ripe to share its fruits.

No greater mistake could be made than to assume that whatever is is right and best. Science is never static, whether "pure" or applied, and the research approach is the key to the future of engineering.

* * * *

## *A Market Lies Dormant for Lack of Teamwork*

FOR some time nearly every one who could derive a benefit from the installation or operation of industrial electric heat applications has been asking, "Why isn't electric heat being sold more extensively for industrial processes, considering all its advantages?" It has not been uncommon for utilities to be accused of lack of interest or energy in going after this new business. Often they have heard it repeated that electric heat applications will eventually require more energy than all existing motor drives.

But "buck passing" will never sell the electric idea. Several things are needed to accelerate a wider-spread use of electric heat applications. One is the appreciation by every one in the electrical industry that the use of electric heat means more than the sale of kilowatt-hours, heating elements, instruments, control and oven or furnace structures. Every kilowatt added will eventually require a proportionate purchase of all those materials and equipments that make up generating stations, transmission lines, substations and distribution circuits. This being the case, every manufacturer in the electrical field should be interested in demonstrating, by example if possible, the specific benefits of using electric furnaces or ovens.

Certainly the collection and dissemination of experiences which prove the advantages of electrical operation should be the continuous object of every one in the industry, because all will benefit by development of such a fertile field. Every industrial process that requires heat should be considered a possible application for electric heat until a survey of the territory is made to ascertain the relative economies of such applications. After a market analysis of this kind the sales approach can be determined and adequate, competent man power can be organized to handle the prospects.

Selling has been hindered by two conditions that should be rectified—(1) an indifferent or even negative attitude on the part of some combination gas and electric companies and (2) lack of co-ordination between electrical manufacturers, oven builders and utilities. What is best for the customer should determine the policy of combination utilities, and united effort to sell the electrical idea ahead of individual products should be the basis for correcting the second weakness.

* * * *

## *Have Other Practices Outgrown Justification?*

DURING the development of an industry, when progress is so rapid that it is not possible to subject every detail to careful scrutiny, precautions are often employed which upon further investigation prove unnecessary. Once such precautions have been introduced they generally linger and are difficult to eradicate, mental inertia preventing.

When outdoor substations were first developed it did not seem natural to mount pin-type insulators in a horizontal position. The "petticoats" seemed to be intended to hang vertically. However, substation designers did ask for bids on insulators mounted at 45 degrees, a compromise between the vertical and the horizontal, and these 45-degree designs soon crept into the catalogs of both small and large manufacturers. Insulator manufacturers began making tests and found that a petticoat insulator or a post insulator mounted at 45 degrees offers no advantages over one mounted horizontally. In fact, the wet flashover value is in most cases higher for the horizontal mounting. Now the more thoughtful station designers and manufacturers no longer hesitate to mount insulators horizontally, and few of them recommend the 45-degree position.

A survey of other electrical practices might reveal some which are likewise persisting without reason because rapid development has prevented a widespread investigation. Possibly a program for determining the "why" of some practices would effect simplification and economies.

* * * *

## *Utilization of Wood Waste*

IN THE service areas of many central stations are sawmills or woodworking plants that produce large quantities of wood waste. Because it seems the obvious thing to do, such industries have usually employed the wood waste for fuel to produce their own power and purchased power has received little consideration.

Utilities seeking new markets for power are not willing to admit that the obvious use for wood waste is necessarily the correct or economical one, and they have individually attempted to find uses that can be applied locally without costly transportation of the waste. Some uses have been found, such as wood distillation for alcohol content and the manufacture of plaster board, rayon and moderate-temperature insulation, but few have wide enough application to absorb more than an insignificant portion of the huge volume of wood waste produced daily.

Nevertheless, the problem must be solved if electric light and power companies expect to develop a large market among woodworking plants. Other organizations may eventually profit from turning wood waste into new channels of use, but right now central stations have the most interest in this subject. Therefore they will have to initiate research into the utilization of wood waste if any is to be conducted in the near future.

Individually utilities may not be able to justify the expenditure necessary for a thoroughgoing investigation, but collectively they can start something. First, they can compile all the uses to which wood waste has been applied; then they can endeavor to obtain the joint support of research by woodworking industries, the chemical societies, research departments of colleges, the Department of Commerce and industrial development commissions.

The chemical and physical characteristics of wood, even in the form of sawdust and shavings, must have more value than the B.t.u. value. Possibly some research fellowships or prizes for economical uses of wood waste that can have widespread application will stimulate the desired investigation.

* * * *

## *Economic Control and the Electrical Designer*

AS THE pressure increases to reduce the over-all cost of furnishing electrical service per unit sold, the economic importance of efficient designing deserves wider executive recognition. The relation between the drafting table and the construction budget is closer than is sometimes realized by managers trained mainly in sales or accounting methods. Executives with an engineering background generally appreciate what might be called the multiplying power of design details expressed in terms of annual charges upon plant investment or in modifications of operating expenses, but as executive interests broaden it is easy to overlook the necessity for putting design responsibilities only in the most competent hands. From his humble status in pre-war decades on smaller properties, the engineering draftsman specializing in electrical design has attained a position in which his equipment and station layouts often set the pace for construction methods and plant investment standards over substantial territorial areas and even through far-flung subsidiary companies. Thus his influence upon costs may turn the scale of engineering decision in matters of far-reaching import.

Adequate project diaries contain innumerable illustrations of savings due to skillful changes in electrical design. Thus, in a city substation built on land worth $10 per square foot a rearrangement of equipment for minimum floor space, without sacrifice of service reliability or reduction of operating safety, cut down the necessary area by 2,000 square feet. In another instance the substitution of automatic for manual switchboard control was effected with nominal increase in equipment, eliminating the need of an operator at $1,800 per year, equivalent to 6 per cent on a $30,000 investment. Such items could be duplicated the country over—they are all in the day's work of the drafting department charged with electrical design functions—but they indicate how swiftly the decisions of the layout man may be translated into money. Manufacturing organizations profiting from mass production realize how much economic control lies in the hands of the designer, and utility executives will do well to devote more thought to the subject, considering the spreading influence of centralized design upon regional system development and operation.

* * * *

## *Why Not Megawatt-Hours?*

WHEN numerical values habitually run into the billions it is time that the quantities involved were expressed in larger units. The inch and foot are common units of length, but we do not use them to express the distance between cities. We do not express coal consumption in ounces.

The monthly and yearly energy output of the United States has risen to such tremendous figures, when expressed in kilowatt-hours, that it has already become customary to drop the last three digits and to express the energy in thousands of kilowatt-hours. More than one hundred systems in the United States have a yearly output that requires nine digits for its expression if the kilowatt-hour is used as the unit.

The expressions "thousands of kw.-hr." and "000 omitted" are cumbersome. They could be avoided by the use of the "megawatt-hour." Electrical men are perfectly familiar with the megohm, meaning a million ohms, for measuring very high resistances. The megawatt, meaning a million watts or a thousand kilowatts, is just as easily understood.

To the objection that this introduces a new term which the public will have to learn there are two answers. First, the public does not seem to have shown any marked resistance to the acquisition, in a very few years, of a veritable swarm of new terms relating to the automobile, the speed boat, aviation and radio. The second answer is that the beginning would naturally be made by engineers and statisticians, who have to use these large figures relating to energy output among themselves, just as the kilovolt was gradually introduced in connection with transmission lines.

The "megawatt" would eliminate the writing of many, many useless ciphers in the course of a year. Why do things the long way just because it is the old way?

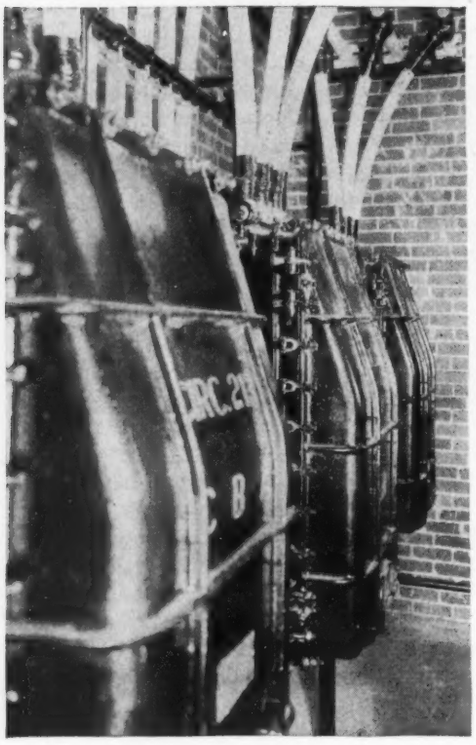
* * * *

## *May Start Pilgrimage*

IN CHARLESTON, W. Va., where natural gas sells below 20 cents per thousand cubic feet, the Appalachian Electric Power Company is embarking on a program of selling electric heat for industrial processes which have hitherto employed the cheap local fuel. Already some business has been obtained. If the courage shown in facing this competition persists, the accomplishments at the end of a year's efforts may surprise industrialists and utility salesmen who do not think beyond relative costs of electricity and fuel.

More power to this enthusiastic commercial department! If it succeeds in selling the "electric heat" idea, Charleston may expect pilgrims from all over the country bent on finding the secret. That secret will undoubtedly involve an evaluation of the intangible advantages of electric heat and a subordination of power costs to the more important items of uniform quality, reduced spoilage, most effective factory layout for production, high labor morale and so on.

# *Network Equipment Anticipates System Changeover*

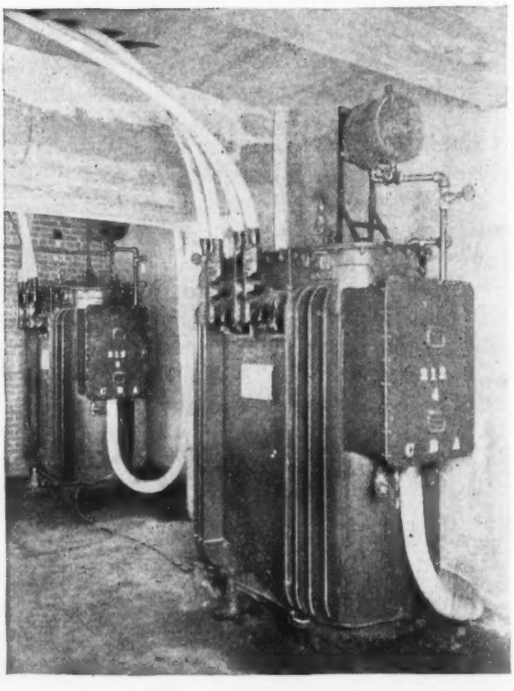


*Three of the four 1,600-amp. submersible motor-operated protectors*

*Two 11,000-volt, 60-cycle feeders supply the network equipment used here*

*450-kva., three-phase network transformers*

IN THE construction of the new Industrial Trust Building at Providence, R. I., network equipment was installed even though the Narragansett Electric Company has not yet changed over to a network system. This permits maximum continuity of service without costly changes at a later date. This installation illustrates the simplicity of the network principle particularly where three-phase transformers are used. In such installations it is only necessary to connect the cable to the transformers, the transformers to the protectors and the latter to the consumer's bus.



*Courtesy of General Electric Company*

# Railroad Electrification Economics

Costs the ultimate controlling factor. Purchased power completely reliable. Some thoughts on standardization

*An Interview with*

E. G. BUCKLAND

*Chairman of the Board*
*New York, New Haven & Hartford Railroad*

RISING interest in railroad electrification is apparent throughout the power industry. Decisions of important trunk lines to push forward extensive programs in certain terminal areas and in districts where steam locomotives cannot hope to meet the traffic requirements with existing or prospective track facilities have opened the way to far-reaching negotiations for the sale of power to railroads. In view of the long and successful experience of the New York, New Haven & Hartford Railroad with electrified operation between New York City, Stamford and New Haven, Conn., a representative of the ELECTRICAL WORLD recently approached E. G. Buckland, chairman of the board of that system, with the inquiry as to what major elements in the problem are holding back the general adoption of electric service by Eastern roads. He said:

"Economic considerations underlie the development of railroad electrification. In notable cases the limitations of terminal facilities, the existence of tunnels and of severe grades, as in mountainous regions, have turned the scale in favor of adopting electric service, but even in these special situations the cost element has been dominant. The outlays which would have been forced by other methods of increasing track capacity or of overcoming geographical handicaps appeared excessive in comparison with electrification costs, great as these are. Density of traffic is the crux of the electrification problem.

### CAPITAL COSTS FORMIDABLE

"Granted that electrified service has become extremely reliable and attractive," said Mr. Buckland, "its capital cost is nothing less than formidable. This retards its progress, because traffic density comparable to that between New Haven and New York does not extend over a sufficient portion of our system to warrant extending electrification on any considerable scale at present. In our case our lines branch in four directions east and north of New Haven, and even with the traffic density of the Boston district we again encounter the problem of electrifying radial trackage extending into thinly settled areas. It is a fair statement that electrification is more than meeting its costs in handling the total service between New York and New Haven, but this is made possible by the traffic density and by the unforeseen growth in real estate valuation in the metropolis, resulting in large measure from the utilization of property above the Park Avenue tunnel."

*E. G. Buckland*

"What do you think of the possibilities of capital cost reduction through standardization of equipment and methods of electrification?" asked the ELECTRICAL WORLD editor. "There is no question," said Mr. Buckland, "that much good could be accomplished if electrification could be changed from what might be called the custom-made variety to a reasonable uniformity of procedure. There are two schools of opinion in regard to standardization. One holds to the idea that railroad electrification is still in the development stage and that the art is still too much in a state of flux to enable engineers to say definitely that one system possesses advantages over all the others for all applications. The fact that there are many systems in apparently successful commercial operation seems to be an argument in support of this theory. To standardize on one system would, on this basis, rob the art of the experience which is still to be gained from the further application of the different systems to various kinds of railroad service.

"On the other hand, there is a strong trend toward standardization in all fields of commercial activity, backed by an economic urge. Many times during their development the railroads themselves have had to accept standardization of gage of track, air brake equipment, automatic couplers and general standardization of rolling stock for interchangeability one road with another. The joint use of terminals and interchange of motive power present the same argument for standardization of electrification.

"The high cost of electrification is due to two principal items: (a) The cost of the distribution system, and (b) the higher cost of electric locomotives as compared with steam locomotives. It seems inescapable that standardization as to system would help to lower the costs of these two items by permitting the manufacturers to place the production of electric traction equipment more nearly on the same basis as electrical equipment for industrial use, which is now largely standardized, instead of 'custom-made.'

"Such standardization, I believe, should originate through the concerted action of the electrical manufac-

turers, in co-operation with the engineers of the railroads. If there is to be any wholesale adoption by the railroads of electrification in the future, except for those special cases where steam operation has reached its limit, it would seem that it can be justified only by marked savings over steam operation, and this does not seem to be generally feasible with prevailing capital costs."

### Engineering Problems Well in Hand

Mr. Buckland was then asked whether the engineering phases of electrification present any serious difficulties in the way of its general adoption as a transportation mechanism. His answer was that the obstacles are economic rather than technical. Some of the New Haven's electric locomotives have been in service more than twenty years and have run more than 1,750,000 miles. Their first cost, however, is two or three times that of the steam locomotive, and this means that they must be most intensively used in order to "keep out of the red." The service records of electrification are widely known from the standpoint of reliability and flexibility.

Queried as to the reliability of purchased power and the preference of the New Haven road in this respect, Mr. Buckland emphatically declared that the art of electrical energy production and distribution has reached a point where the choice between generating power in railroad plants and buying it is merely a matter of comparative costs. "I consider the power which we buy exactly as reliable as our own Cos Cob output," he said, "and I would as soon have one as the other, given comparable costs. The New York Edison and Connecticut Light & Power companies serve us with energy which we count upon as firmly as though we produced it ourselves. Of course," said Mr. Buckland with a twinkle in his eye, "it is an asset, with our excellent load factor, for us to own and operate Cos Cob, but there really is no reason from the standpoints of service quality and reliability to pick and choose between kilowatt-hours produced at Devon and New York and those which might be labeled our own."

"Have you any comments to make on the form of power contract desirable for railroad electrification?" inquired the representative of the Electrical World. "Agreements of this kind are pretty well standardized," said Mr. Buckland. "Contracts must provide for demand and energy requirements, covering charges on equipment necessary to handle the maximum railroad peaks without unreasonable penalties. My observation is that the engineers and executives of the power companies and of the railroads meet on entirely satisfactory bases these days and that power contract negotiations are conducted as a rule with a disposition on both sides to appreciate the other's economic point of view. I have nothing to bring up in the way of suggestion as to how these excellent relations may be bettered."

## Water Power in the United States

Available and Developed

From data published by the U. S. Geological Survey. For potential power by states see water supply paper 579; for developed horsepower, Electrical World, March, 23, 1929, page 588.

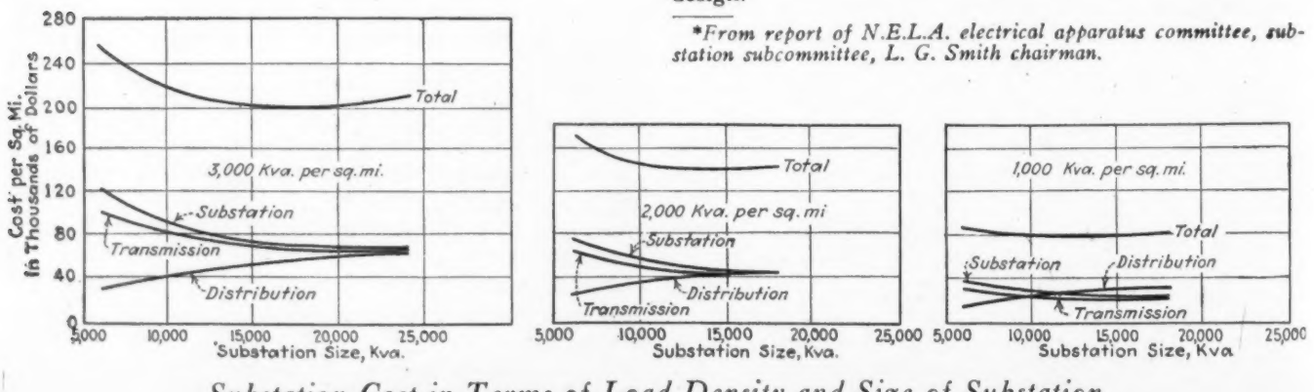
| Region | Horsepower Available (A) 90 per Cent of the Time | (B) 50 per Cent of the Time | Developed Jan. 1, 1929 Horsepower | Per Cent of A | Per Cent of B |
|---|---|---|---|---|---|
| New England | 998,000 | 1,978,000 | 1,653,654 | 165 | 84 |
| Middle Atlantic | 4,137,000 | 5,688,000 | 2,122,999 | 49 | 37 |
| East North Central | 737,000 | 1,391,000 | 1,075,660 | 146 | 77 |
| West North Central | 871,000 | 1,844,000 | 555,049 | 64 | 30 |
| South Atlantic | 2,476,000 | 4,464,000 | 2,595,304 | 105 | 58 |
| East South Central | 1,011,000 | 2,004,000 | 1,118,765 | 110 | 56 |
| West South Central | 434,000 | 888,000 | 47,082 | 11 | 5 |
| Mountain | 10,736,000 | 15,513,000 | 1,140,108 | 11 | 7 |
| Pacific | 13,238,000 | 21,260,000 | 3,262,909 | 25 | 15 |
| United States | 34,818,000 | 55,030,000 | 13,571,530 | 39 | 25 |

## Substation Size and System Costs

THE choosing of the proper size of substation as dictated by economy depends upon the variation in cost of the transmission system, distribution system and the cost of the substation itself, with variation in station capacity. The larger the substation the lower its cost per kilowatt. Likewise, the transmission costs will usually decrease with an increasing capacity of substation due to the smaller percentage of spare capacity, and as a result of the possibility of using higher voltages economically. However, the distribution costs increase with the substation size due to the fact that longer feeders are required as a result of the increased spacing between substations, thus increasing the capital cost and cost of losses.

Therefore, for any load density the choosing* of an economical size of substation is the compromise of these three partially conflicting trends. The accompanying curves showing the costs per square mile show the trend of individual and total costs for three different load densities. It will be noted that the rise in distribution costs with increasing size of substation becomes more pronounced at higher load densities. The same statement may be made for the curve of total costs. Therefore, it can be concluded that at light load densities the size of substation does not materially influence the economy, whereas at higher load densities the size of substation has a more marked effect upon the economy of system design.

*From report of N.E.L.A. electrical apparatus committee, substation subcommittee, L. G. Smith chairman.




*Substation Cost in Terms of Load Density and Size of Substation*

# Test Simulates Service

By T. W. Ayton

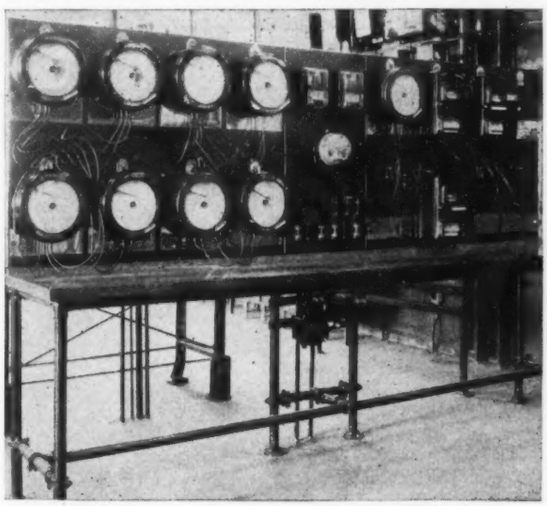
*Superintendent Meter and Testing Department, Indianapolis Power & Light Company*

MOST meter departments, responsible for the maintenance and operation of a large number of graphic demand meters, are confronted with the problem of placing these instruments on test runs in the shop under conditions similar to those encountered in actual service.

On the Indianapolis Power & Light Company system such test runs are made on a table designed by the writer. On the front of the ebony wood panel of this particular table there are sixteen operating positions. Meters placed in any of these positions may be operated from the nearest set of terminal posts. Westinghouse RA watt-hour and demand meters, 100, 200, 400 volts, or any of the various styles of General Electric type G demand meters, a.c. or d.c., and operating from two or three-wire contacts at 100 or 200-watt potential, may be checked on this board.

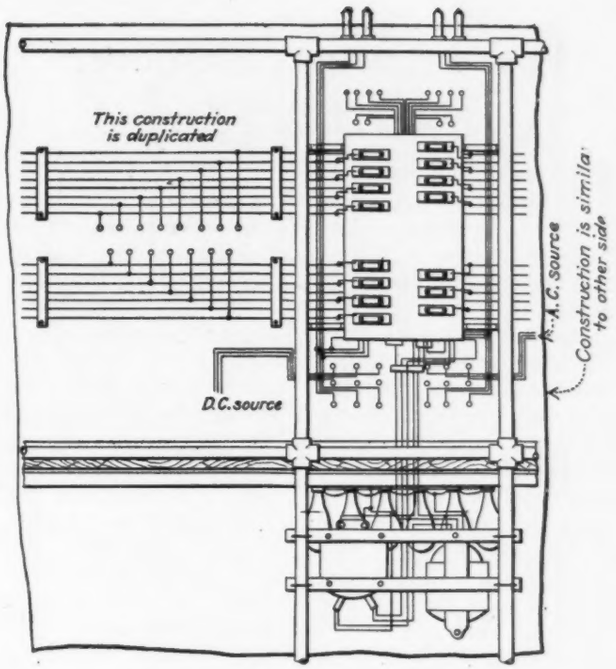
By proper connections from any one of the four terminal groups on the face of the board, a meter under test may receive single or double contact impulses at 110 or 220 volts, a.c. or d.c., or may have uninterrupted a.c. potential at 110, 220 or 440 volts. Two of the terminals are for current connections. The connections between the meters and the board terminals are made with single-conductor super-service cord leads, which are provided with forked and bayonet terminals.

On the center panel are alternating and direct current



*Running test on demand meters*

main line switches, a 5-amp., 100-volt, two-wire General Electric IW-14 watt-hour meter equipped with D-12 contacts and two Westinghouse MC relays which are operated by the meter contact. Each of the MC relays make and break two contacts and from their operation the various types and combinations of contact impulses are supplied to the distribution bus at the rear of the panel. Just below the table is a General Electric type M, form B.O. 5-kva. sign lighting transformer which supplies current for the watt-hour meter elements and is loaded by a bank of five small lamps. The 400-volt potential used in operating RA meters is obtained from a four-to-one ratio type VS transformer.




*Wiring layout of test table*

The accompanying illustrations show clearly the frame construction of 1¼-in. iron pipe which is assembled with Westinghouse switchboard fittings; also the supply bus, terminal connections and fuse board located in the center section rear of the panel. Brass rod ⅛ in. in diameter clamped between Bakelite blocks is used for the supply bus. The connection between this bus and the States Company terminals which appear in the four groups was made with ¼-in. 0.0625 hoop brass.

## Bare Neutral Wiring

ACCORDING to a report recently published by J. D. Noyes of the Detroit Edison Company, something more than a year ago, the chief electrical inspector of the city of Evansville, Ind., decided there were no real objections to the use of bare neutral wiring on single-phase grounded 115/230-volt circuits and prepared rules for its use. The rules were permissive and not mandatory. The local utility (Southern Indiana Gas & Electric Company) co-operated in the program. In a year's time some 1,400 jobs have been installed with entirely satisfactory results. These range in size from single residences up to large office buildings, schools, apartments and factories.

The electrical contractors of Evansville have placed their written indorsement of this work on record with the local utility. They approve it for its safety, simplicity and for the economies it has effected for their customers. Evansville rules require the use of soft-drawn bare copper, because it does not break easily in making sharp bends in drawing in or around terminals, etc. Larger sizes are soft-drawn stranded standard conductors. Conduits are well bonded at cabinets and boxes with a grounding bushing or washer to the neutral wire. Services are, of course, grounded to the water piping system. The method is used only with rigid conduit construction, there being, of course, no bare neutral cable assembly available at present.

# Fuse Interrupts Flashover*

By Philip Stewart

*Union Gas & Electric Company, Cincinnati, Ohio*

FOR service reliability the four 66-kv. lines to the Terminal substation of the Union Gas & Electric Company, Cincinnati, Ohio, from Columbia station, 20 miles away, have been equipped with fused arcing horns or fused grading rings. The function of the fuse is to interrupt the power arc following an insulator flashover.

The first arrangement using fused rings consisted of a string of seven insulator units and was provided with two horns at the top and a split oval ring below the fifth unit. Fuse clamps were mounted on the ring and conductor clamp, thus shunting the two lowest insulators with a fuse. After the fuse has been blown, the insulator will consist of seven units. In this way the flashover distance will be increased, and it was thought that in case a second surge originated near this point before the fuse was renewed, the flashover would occur at the next adjacent point of support. Tests were made with this arrangement to observe performance. The tests were made on a line from the main bus. The insulator string was shunted by a piece of small copper wire in order to start the flashover. The line was closed in on the shorted insulator by means of the station oil circuit breaker. An oscillograph was used in order to obtain the short-circuit currents and voltages. An average short-circuit current of 2,970 r.m.s. amperes was obtained, with 9,000 volts phase to neutral during short circuit. Ten-ampere, 37,000-volt carbon tetrachloride fuses cleared in one cycle, in each case clearing before the relays operated the oil circuit breakers.

In the spring of 1927 fused arcing rings were installed on two of the Columbia-Terminal circuits, and four on the shorter lines, leaving Terminal, totaling approximately 65 miles of circuit so equipped. During an eight-month period succeeding this installation there were six cases of the fuses blowing and clearing without an interruption to service. There were three cases in which the fuses failed to clear and the circuit breaker opened, interrupting service on the line. During this period ten fuses were blown. The three service interruptions were caused by the destruction of the fuses at the flashover points.

It is noted that the fuses functioned properly 77 per cent of the time and succeeded in preventing service interruptions 67 per cent of the time. The operation of the fused arcing rings, using carbon tetrachloride fuses, was successful in preventing a number of service interruptions on the two Columbia-Terminal circuits on which they were installed. In considering the installation on the two remaining circuits a more economical arrangement of the device was desired. First, the added cost for extra insulator units shunted by the fuses did not seem to be justified by the first year's operation; second, the carbon tetrachloride fuses were more expensive than expulsion type fuses. Therefore, the next development was an arrangement using two expulsion type fuses in place of the horn at the top of the insulator string, and a ring at the conductor end.

**Abstract of paper presented before second district A.I.E.E. regional meeting, Cincinnati, Ohio.*

*Operating Record With Fused Arcing Horns*

| Line | Year | Interruptions | Flashed Units | Type of Fuse | Interruptions Prevented | Fuses Blown |
|---|---|---|---|---|---|---|
| 1761 | 1926 | 3 | 30 | None | .. | .. |
| | 1927 | 2 | 6 | Carbon tetrachloride | 4 | 9 |
| | 1928 | 0 | 0 | Carbon tetrachloride | 1 | 1 |
| 1762 | 1926 | 4 | 14 | None | .. | .. |
| | 1927 | 1 | 2 | Carbon tetrachloride | 2 | 4 |
| | 1928 | 0 | 0 | Carbon tetrachloride | 1 | 1 |
| 1763 | 1926 | 1 | 0 | None | .. | .. |
| | 1927 | 4 | 18 | None | .. | .. |
| | 1928 | 0 | 0 | Expulsion | 1 | 1 |
| 1764 | 1926 | 2 | 6 | None | .. | .. |
| | 1927 | 3 | 24 | None | .. | .. |
| | 1928 | 0 | 0 | Expulsion | 1 | 1 |
| 1261 | 1926 | 1 | 0 | None | .. | .. |
| | 1927 | 0 | 0 | Carbon tetrachloride | 0 | 0 |
| | 1928 | 1* | 0 | Carbon tetrachloride | * | 2 |
| 1262 | 1926 | 3 | 6 | None | .. | .. |
| | 1927 | 0 | 0 | Carbon tetrachloride | 0 | 0 |
| | 1928 | 1* | 6 | Carbon tetrachloride | * | 1 |
| 861 | 1926 | 0 | 0 | None | .. | .. |
| | 1927 | 0 | 0 | Carbon tetrachloride | 0 | 0 |
| | 1928 | 0 | 0 | Carbon tetrachloride | 2 | 3 |
| 862 | 1926 | 0 | 0 | None | .. | .. |
| | 1927 | 0 | 0 | Carbon tetrachloride | 0 | 0 |
| | 1928 | 2 | 0 | Carbon tetrachloride | 0 | 3 |

*Flashover at substation.

In the early part of 1928 the fused horn and grading rings were installed on the two Columbia-Terminal circuits not previously equipped with fused arcing rings. During this year there were no interruptions to service on any of these four circuits. Although there were comparatively few lightning storms, four fuses were found blown, indicating that they had been effective in preventing service interruptions.

After two years' operation there have been seventeen cases of flashovers on lines equipped with fused horns or arcing rings. In twelve of these cases interruptions were prevented. This is an elimination of 70 per cent.

# Caterpillar Tractor Aids Mountain Line Construction

RAPID and economical construction of a pole line was made possible over a 3½-mile steep and almost inaccessible section of the Berkeley Hills, California, by the use of a "Caterpillar" tractor. The tractor was used to haul material, it being the only machinery capable of negotiating the steep terrain, hauling two ½-ton reels on a special trailer made by putting Athey wheels on a standard reel trailer. In addition the tractor was invaluable in raising poles and placing material.

# *Characteristics of*

# Line-Start Motors

Slight difference from general purpose type. Need for clearer statement of effect of starting on line. Extrapolated blocked rotor current values not generally correct

By G. R. ANDERSON
*Development Engineer Fairbanks, Morse & Company, Indianapolis, Ind.*

DURING the past few years a variety of motor trade names have sprung up—"Auto Start," "Switch Start," "High Reactance," "Line Start," etc.—all of which attempt to convey the idea that the particular motor can be started by a simple switch or contactor. This naturally leads one to ask about the special features of such a motor that allow it to start directly across the line and wherein it differs from a general-purpose motor.

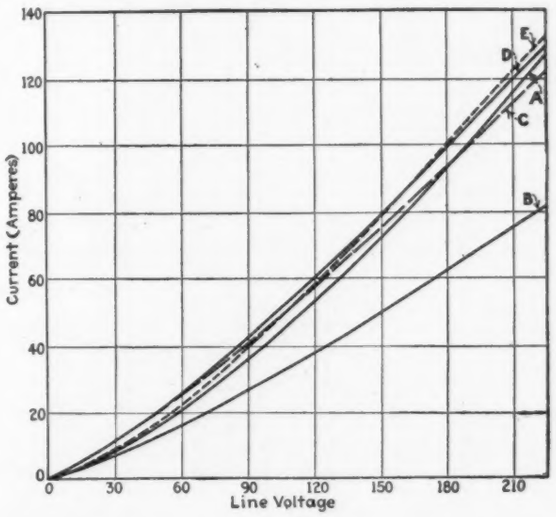
In actual ruggedness of construction and mechanical features the line-start motor and general-purpose motor are practically identical. Both motors will start on full voltage without injury to themselves, although the general-purpose motor will probably have a little higher rate of acceleration due to its higher maximum torque. Both have the same temperature guarantees, but the general-purpose motor should have slightly the best operating performance. The line-start motor, however, will draw less current from the line during its starting and accelerating period than the general-purpose motor. This feature is accomplished by special arrangement of the rotor winding and magnetic circuit and is entirely automatic in its operation.

Most line-start motors up to and including 30-hp. ratings are designed to draw a current from the line at start not greater than the limits established by the N.E.L.A. These rules relative to three-phase, 60-cycle motors are quoted briefly as follows:

"The instantaneous current (determined by test or based on values guaranteed by manufacturer) drawn from the line by any motor must not exceed the value for the rated horsepower of such motor as obtained from the following tables.

"If the starting current of the motor exceeds the value given to the tables, a starter must be used or other means employed to limit the current to the value specified."

Two sets of current values are given. The first set, called "free rotor values," consists of current values indicated by a suitable well-damped ammeter located in the motor circuit on the line side of the starter (if one is used) with the motor connected to its load and starter in the position necessary to start the motor. The second set consists of "blocked rotor values," which may be obtained from the manufacturer or by test. If a test is required it should be made at one-quarter or one-half voltage, for motors will not stand full voltage long enough to take readings. The "free rotor values" are 75 per cent of the "blocked rotor values." In cases of discrepancy, the "blocked rotor values" shall be considered the standard starting current values.




*Blocked rotor current of five 7½-hp., 1,800-r.p.m., three-phase, 60-cycle, 220-volt line start motors*

*Table I—Motor Starting Current Values*

| Hp. | Three Phase, 60 Cycles, 220 Volts Starting Current Free Rotor | Blocked Rotor |
|---|---|---|
| 3 | 45 | 60 |
| 5 | 65 | 86.6 |
| 7½ | 86 | 115 |
| 10 | 106 | 141 |
| 15 | 148 | 197 |
| 20 | 188 | 251 |
| 25 | 228 | 304 |
| 30 | 270 | 360 |
| 35 | 277 | 370 |
| 40 | 285 | 380 |
| 50 | 300 | 400 |
| Amperes per horsepower, 60 horsepower and above | 6.0 | 8.0 |

Obviously, the values given in Table I cannot be applied indiscriminately without knowledge of local conditions affecting the power supply to a motor. There are an increasing number of large installations where the starting of a 500-hp. motor directly across the line could be satisfactorily made, while there are undoubtedly many

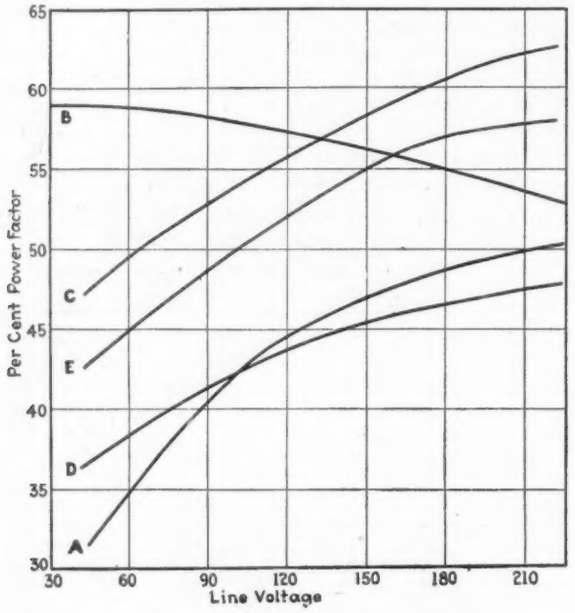
other cases where the starting of a 5-hp. motor is objectionable to service. The result is that power companies make rules to fit their own particular needs. A few quotations from representative "local rules" are given briefly as follows:

(a) Three-phase motors of 15 hp. or less may be connected to the lines without a starting compensator.

(b) Three-phase motors over 15 hp. must have starting compensator or equivalent device, such as rotor resistance or star-delta connection, which will limit starting current to 2½ times the full load current.

(c) No starting device will be approved that disturbs the regulation or continuity of service to other customers.

Rules (a) and (b), while definite in horsepower value, are unsatisfactory from almost every viewpoint. A line-




*Blocked rotor power factors of the same five motors*

start motor of 20-hp. rating might require less starting current than a general purpose motor of 15 hp., and yet the 20-hp. motor must have a starter in order to meet the rules.

On the other hand, rules such as (c) allow both the customer and central station to use equipment to the best advantage. Rules of this character should undoubtedly prove the most economical in the long run. Disturbance to service should be the measure used in determining whether or not a motor may be permitted to start directly across the line.

While the N.E.L.A. rules are definite in stating that "blocked rotor values" shall be the basis of measurement of starting current, they allow this current to be measured at one-quarter or one-half voltage. It is therefore necessary to extrapolate the reading obtained, on the basis that the starting current is proportional to the voltage in order to obtain the value of starting current at full voltage. In actual practice, however, the ratio between current and voltage under blocked conditions is not constant. Values obtained by measurement at half or quarter voltages are therefore lower than the actual current demand of the motor at full voltage. The first graph gives the current voltage curves (blocked rotor) of five different motors of the same rating. It will be observed that the actual current at full voltage is from 15 to 25 per cent higher than the extrapolated current.

From the experience gained in testing a large number of motors there is no particular difficulty in measuring starting current at full voltage. The limiting factor is not the motor, but rather the power supply used for testing. The circuit should, of course, be arranged for taking readings quickly. It should also be noted that the temperature of the motor will greatly influence the value of the reading obtained on test. While the highest value of current will obviously be obtained when the motor is cold, nevertheless, since running performances are guaranteed on the basis of operating at full load temperatures, it would seem only fair that starting current guarantees should be based on measurement with full voltage at full load temperatures.

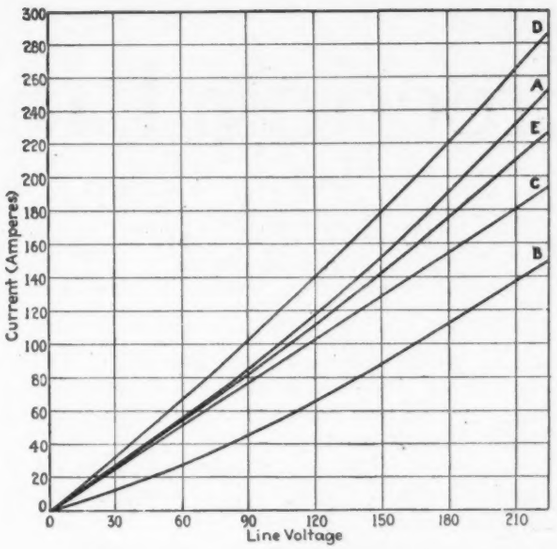
Local rules based on the theory that one customer should not cause a disturbance in service to any other customer naturally leads to the question as to what factors there are that cause a voltage drop in the line when a motor is started. It is a well-known fact that the voltage at the end of a given line depends on the load in amperes and the power factor of the load. Therefore, when a motor is started, the drop in voltage depends not only on the amount of current drawn by the motor but also on the angle of lag of the starting current. The drop in voltage caused by a motor taking 100 amp. at 40 per cent power factor is much greater than that caused by a motor taking 100 amp. at 70 per cent power factor. The disturbance caused by the starting of a motor therefore depends directly on the starting current and inversely as the starting power factor. The second graph shows the relation of the blocked rotor power factor and voltage of the five motors previously referred to.

### Measurement of Line Disturbance

Since the disturbance to a line depends directly on the starting current and inversely on the starting power factor, it is logical to assume that the quotient of these values would provide an excellent means for comparison of the starting requirements of line start motors. "Line disturbance current" is, therefore, defined as the starting current divided by the starting power factor. While theoretically the starting power factor might be zero, thus making the "line disturbance current" infinite, such

*Table II—Test Performance of Motors*

| Motor | Voltage Drop Test No. 1 | Voltage Drop Test No. 2 | Voltage Drop Test No. 3 | Voltage Drop Test No. 4 | Voltage Drop Test No. 5 | Voltage Drop Test No. 6 | Average Voltage Drop | Drop per Ampere of Line Disturbance Current |
|---|---|---|---|---|---|---|---|---|
| A | 20 | 10 | 43 | 47 | 56 | 26.5 | 33.75 | 0.137 |
| B | 17 | 14 | 46 | 32 | 37 | 16 | 27 | 0.185 |
| C | 16 | 9 | 32 | 45 | 50 | 25 | 29.5 | 0.155 |
| D | 29.5 | 16 | 62.5 | 51 | 58 | 27 | 40.67 | 0.146 |
| E | 15.5 | 10 | 38 | 46 | 55 | 25.5 | 31.67 | 0.143 |




*Blocked rotor currents of the same five motors in terms of line disturbance*

a condition does not occur in actual practice. The third graph shows the relation between the "line disturbance current" and voltage for the same five motors. It will be noted that these curves are much nearer a straight line than those of blocked rotor values. Thus the measurement of "line disturbance current" by extrapolation of readings taken at one-quarter or one-half voltage is not subject to as great an error as is the case with starting current measurements.

In order actually to check the disturbance caused by each of the five motors when started on different power lines, tests were taken of each motor starting a load of relatively slow acceleration and a load of relatively rapid acceleration on three different lines. The voltage drop under each condition was recorded, with results as shown in Table II.

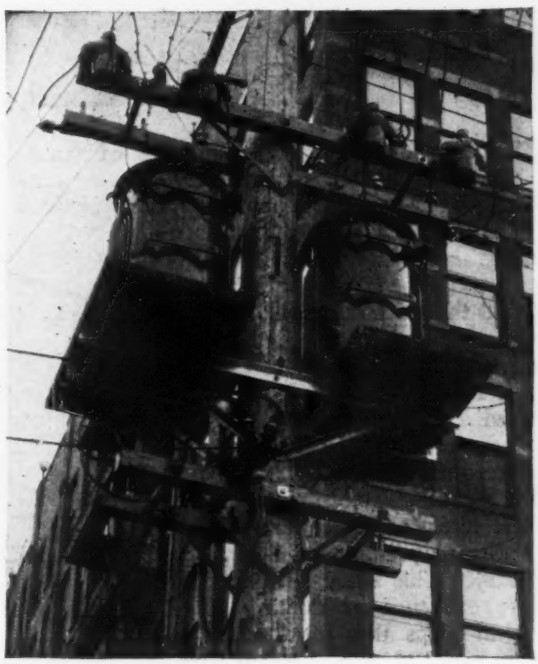
No attempt was made to determine the differential in voltage drop due to slight differences in starting torques developed. However, it will be noted from the above table that the volts drop per ampere of "line disturbance current" for motors "A," "C," "D" and "E" were practically the same. This indicates that the use of "line disturbance current" for measurement of the starting requirements of motors will give results fairly accurate. This unit of measurement is also more satisfactory when used in comparing motors of different characteristics than would be the case if the starting currents were compared.

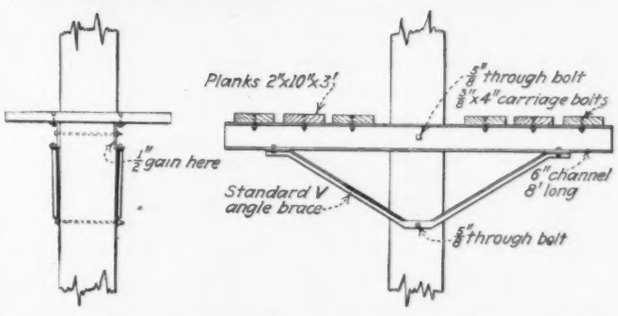
The divergence of motor "B" from that of the four other motors was due to its special rotor construction, in which there was a mechanical change in the rotor magnetic circuit that gave a slight time delay action and produced the effects indicated.

Guarantees as to efficiency, power factor, starting and maximum torques of various types of squirrel cage motors are readily furnished by motor manufacturers and methods for obtaining these data from tests are fairly well established and standardized. Values from which the customer or central station can estimate the disturbance a motor will cause to a line when started are not so well defined nor readily obtainable. The advent of the line-start motor and its fair comparison with motors of other types should call for a standardized unit of measurement by which starting performances can be compared readily. As a result, the following suggestions may prove food for thought:

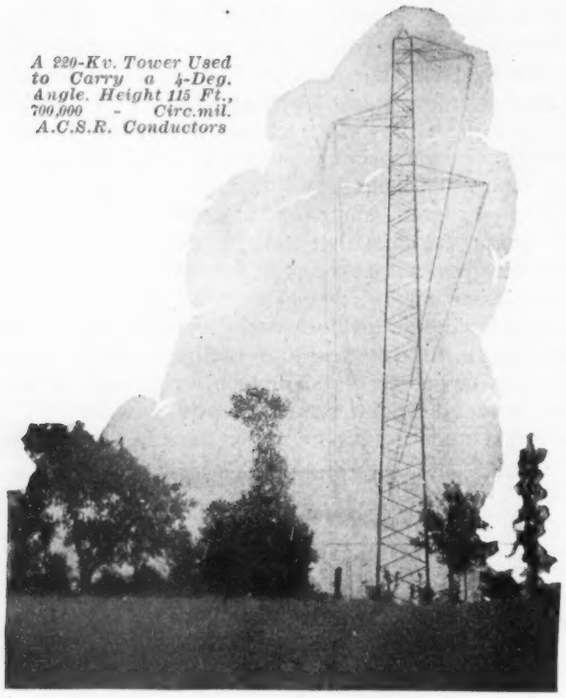
1. "Blocked rotor values" of measurement of starting current should be the only recognized value.
2. Starting current should be taken at full voltage at least up to ratings including 30 hp.
3. Starting current should be measured at full load operating temperature with a stated ambient temperature.
4. Starting power factor should be measured the same as starting current.
5. A standard unit of measure should be devised to evaluate the disturbance a motor will cause in starting. The starting power factor should be recognized in formulating any unit of measurement of this kind if a satisfactory standard unit to be developed.

## Single-Pole Platform for Two Transformers






QUITE frequently, in concentrated load areas, it is necessary to place transformers at points where it is impossible to erect two-pole platforms. To overcome this difficulty the type of construction illustrated has been used in Winnipeg, according to T. A. Robinson of the Hydro-Electric Commission. This structure will support transformers rated up to 50 kw. The secondary leads are carried through porcelain tubes in the platform floor directly to potheads, from which the circuit continues in lead-covered cable.



*A 220-Kv. Tower Used to Carry a 4-Deg. Angle. Height 115 Ft., 700,000 - Circ.mil. A.C.S.R. Conductors*

# Erecting Lines

By René P. Chauvet
*Morges, Switzerland*

THE conditions for the building of transmission lines in Europe vary a great deal from one country to another. All regulations are more or less severe, but, as a rule, the more the country is electrified the more the legislation is liberalized and the rules softened. This is the case in England today. For example, the duplication of conductors over a road or railway is no more required. Some countries require in this case double insulator chains and reinforced towers.

The great density of the population and the intensive agriculture make a very careful preliminary line study necessary. This study is made easy by the existence of military topographical maps that make unnecessary an aërial survey. Certain legislation forbids the overhang of houses. Also, one must take notice of the public opinion, that fights, often tenaciously, against the so-called "disfigurement" of the countryside by transmission lines. Once a line is studied and planned it is submitted to a public examination and each citizen has the right to make opposition to its construction. The right-of-way is purchased by private contract and is relatively dear. The cost of right-of-way, for conductors only, varies from $0.02 to $0.10; for towers, from $12 to $50, varying according to dimensions at the foot of the tower. It is only when the parties do not agree that condemnation takes place, and even then only after long formalities.

Up to 60 kv., transmission lines are nearly always established with pin insulators, on wooden, concrete or steel poles. The wooden pole is always impregnated and sometimes concrete bases are used. The American type of crossarm is seldom used; one prefers always independent fixation of insulators, with curved pin fixed on the side of the pole.

The concrete pole is very much used in France, Germany, Italy (up to 240 kv.) and Sweden, but it is very heavy and not in general use for cross-country lines. In France concrete pole lines follow the roads and centrifugal cast poles are preferred.

Steel poles, latticed and tubular types, have the preference in Europe. Three types of tubular poles are in use. Poles without seams, made of weldless steel tubing and circular in shape, are made in Switzerland. Poles made of welded steel plates, oval in shape at foot and round at top, are used mainly in Switzerland. In England a steel pole is made and used that is composed of a vertical tubular section that occupies two-thirds of the total height, the lower third being occupied by four inclined tubular members that are brought together under the vertical section and support it. Four stays join the feet of the inclined members to the top of the vertical section. This "Kag pole" is in use mainly in metallurgical countries, especially in Luxemburg and Germany. Steel-latticed poles are in use in all parts of Europe.

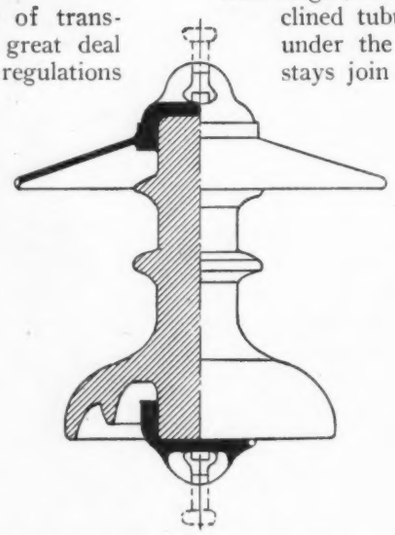


*Fig. 1—Double Cap Type Insulator*

In planning a line one permits angles by using dead-end towers supporting the entire angle. In other cases, and this is now the trend, the tower employed normally on straight line is designed to be able to support a small angle, and great deviations are divided between many such towers, equipped with vertical insulator strings, so that each supports only a part of the total deviation.

To avoid damages to crops it is often necessary to build the line in

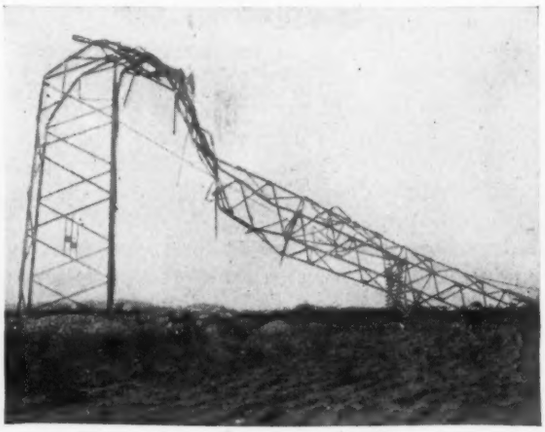


*Fig. 2—Failure of a Dead-End Tower Designed with a Safety Factor of 1.75*

# in Europe

**Conditions vary, but trend is toward standardization. Tower, pole, insulator and conductor design and construction**

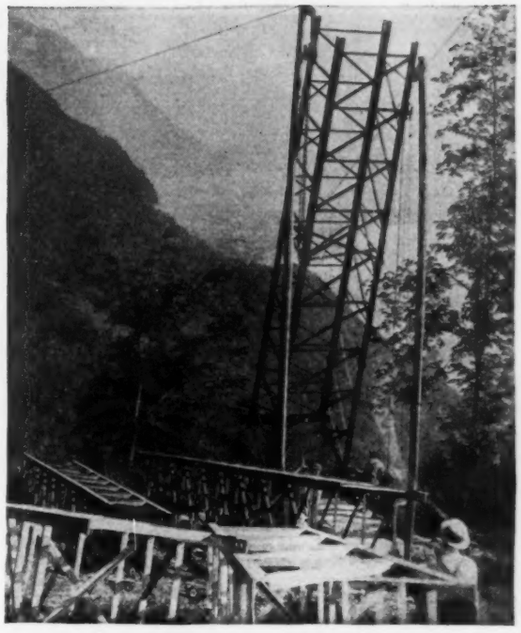


*Fig. 3—Erecting a 137-Ft. Tower, Section by Section*

Tower is entirely arc welded for 2,450-ft. span, 132 kv., eight A.C.S.R. conductors.

autumn and winter. In general, the electricity undertakings do not undertake the line construction work themselves, but utilize specialized contractors who have competent staffs. In Germany there are five contractors, in Switzerland six, in Italy two, in France seven, and in England five who are really very well equipped with crews and tools to undertake successfully any construction. British contractors, for instance, are engaged in line erection in India, Persia and Hungary. Swiss contractors have crews at work in Spain, Austria, Italy and Belgian Congo.

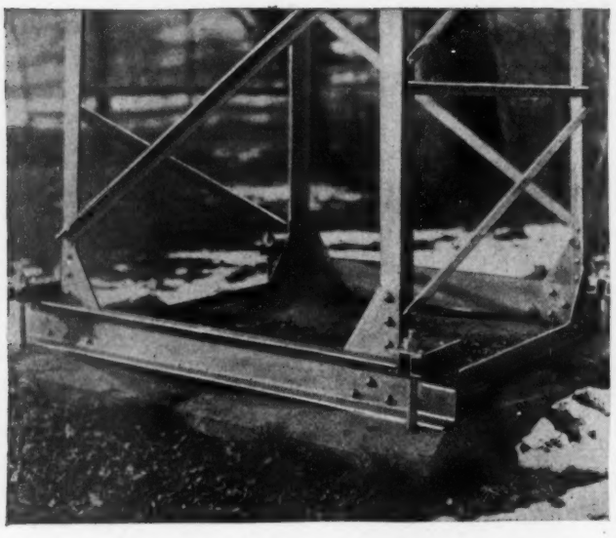
Because of the rivalry between contractors, prices are reduced and delays in construction are more and more curtailed. For instance, a 130-kv., 45-mile transmission line in a mountainous country, with eight conductors, has been constructed in four months. Another transmssion line, 85 miles long, at 220 kv., has required eight months.

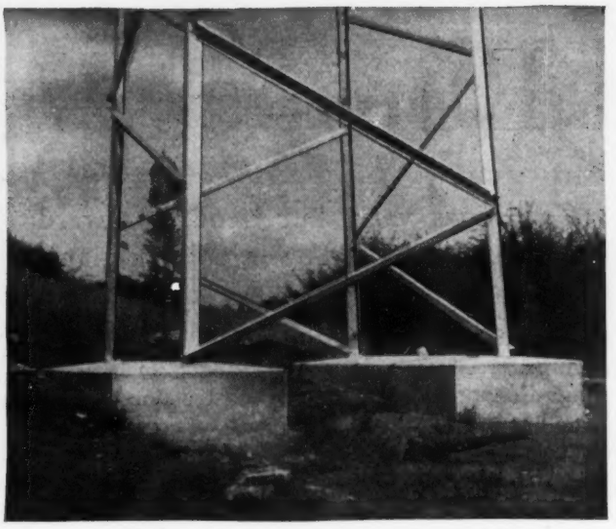
In France the contractors not only do the line erection, but also everything from the inception, including the study, purchase of right-of-way and buying towers and conductors. In Italy, Germany and Switzerland the contractors are only engaged in erection and the owner of the line provides the necessary plans and materials. Mechanical equipment is still used very infrequently because it is seldom possible to employ it on account of economic conditions. For instance, an earth drill, costing in the United States $1,875, represents in France the value of 15,635 groundman's hours, at the rate of 3 francs an hour. However, for certain transmission lines in rough country mechanical equipment with stationary winding engines has been used with success

*Fig. 4—Attaching Shield Ring to Insulator*

*Fig. 5—Hoisting Insulator String*

*Fig. 6—Guy Prevents Cross-Arm Twisting*





*Figs. 7 and 8—Tower Foundations Used in Switzerland and France*

for the paying out of conductors, but these are exceptional cases. Labor is abundant and comparatively cheap in all Europe. Italians, Poles and Spaniards make excellent groundmen; they are sober and are not fastidious as regards their meals and quarters.

Usually the tower is fixed to a concrete foundation made beforehand, often during the summer season. In Switzerland holding-down bolts are customarily cast into the concrete foundation and maintain the tower by the help of a shoe built up of channels and plates (Fig. 7). In France the preference is to place in concrete the lower part of the tower; i.e., two panels, built up of angle iron, which are joined to the tower feet by fishplates. These fishplates are afterward covered by concrete, to hinder any attempt at sabotage (Fig. 8). The setting templates, made of U-beams, are maintained in place during concrete work for the bases. The beams are put level by screws engaged in a guide at each extremity of the beam and resting on an iron plate 3 in. x 3 in.

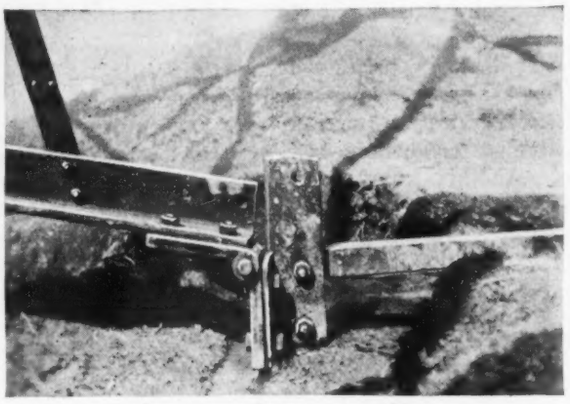


*Fig. 9—Hinge for Swinging Tower*

### Two Types of Footings Used

When the foundation is made beforehand the tower is fixed to the concrete block by holding-down bolts or fishplates, joining together anchor stub and main tower leg, which are afterward covered by concrete. This last fixation is less expensive, but if the anchor stubs are not exactly level, it is difficult to set the tower vertical, whereas in the case of the precast blocks a wedge inserted between the block and the leg compensates for the error in the upright. In the case of lines of small importance the tower is concreted in the excavation, which complicates the methods of erection.

The towers are built up of legs strongly cross-braced, with corners of flat steel. The upper part and the crossarms are often galvanized. The practice of live-line maintenance is forbidden in Europe.

In some special cases new constructions have been adopted; for example the Swiss Federal Railways has adopted towers built up of legs made of U-channels assembled back to back and braced by steel tie rods. This construction was very costly and has been abandoned, but 60 miles of lines with 66- and 135-kv. circuits are established on such towers.

The crossarms are generally formed of angle shapes, four in number, that are joined together at the cross-

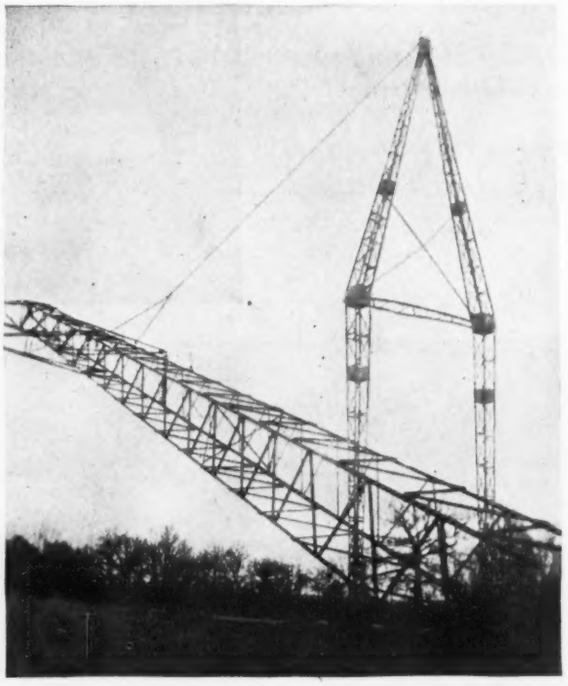


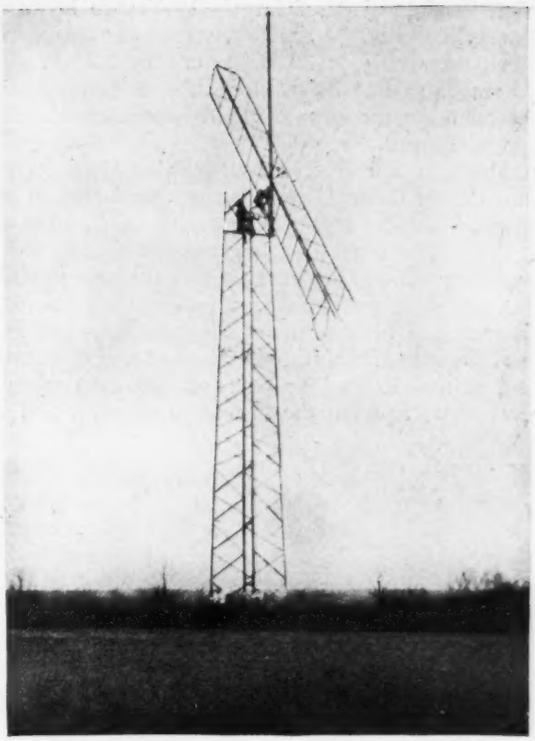
*Fig. 10—Swinging an 8,000-Lb. 120-Ft. Tower on the Hinge*

The leg of the tower is joined to the anchor stub by eight fishplates.

arm end to two gussets bearing a short U-iron for the support of the insulator string. Quite often the practice is to use as a crossarm two U-beams, one on each side of the tower and coupled at their extremities. The crossarm forms the weak part of the construction. The author has been a witness to several casualties, happening mainly to anchor towers, where the crossarms broke off at the stringing of conductors under the weight of vertical component of the cable.

### Erecting Methods

The disadvantage of designing anchor towers without taking note of the fact that the effort at the stringing of conductors can exceed many times the normal load for which the tower is designed, with a safety factor sufficiently high, is shown in Fig. 2. This tower, 105 ft. high, supporting three 700,000-circ.mil A.C.S.R. conductors, was designed to support the load with a safety factor of 1.75. It gave up through twisting two hours after the application of the load.



*Figs. 11 and 12 — Raising Towers by Sections*

The methods of erection vary with the contractors and the types of foundation. When the foundation is one with holding-down bolts the tower may be lifted as a single piece or in sections. The erection by separated sections, which is very fast, requires a more competent staff than the erection by swinging the tower about two hinge points. This method requires a great number of tools. A comparison of the two methods is in favor of the former in the case of heavy or high towers.

Thus, for the erection of the 527 towers of a 220-kv., 85-mile-long transmission line, with towers from 96 to 124 ft. high and weighing from 8,000 to 12,500 lb. in ten different types, both methods were used. First, the complete tower was erected by swinging it about two hinge points (Fig. 9) with the help of a steel shear pole, made demountable for transport, 46 ft. high and weighing 1,300 lb. (Fig. 10).

The tower was first raised at its top by a 20-ft. pole equipped with a windlass. Once the tower was raised by the pole the steel pole worked alone with a heavy hand windlass set 250 ft. in. front of the tower. This method required a gang of fourteen men and a motor truck was necessary for the transportation of the numerous tools, poles, windlass, etc. The erection cost of a tower, swung this way, amounted to from 500 to 780 francs ($20 to $31). The shear pole, which was held in place by eight guys, was reversed when the pulling cable had left the head pulley.

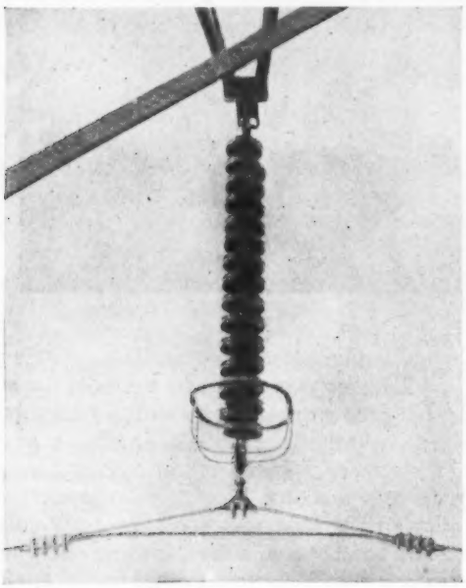
A new method, little practiced up to now in France, was adopted at the author's suggestion. The three lower sections (Fig. 11), weighing 5,000 lb., are lifted in one operation by means of a 37-ft. pole. A small windlass is fixed to the pole and works a four-part tackle. Once these three sections are up the winding engine is fixed at the main member of the tower and the two top sections, weighing 2,500 lb., are raised by the pole fixed at the top of the already raised sections (Fig. 12). A gang of eight men, with a total of 1,700 lb. of tools, including the pole and a light hand cart, can set easily two towers a day. The towers were delivered in five riveted sections and assembled in front of the erection crews by a special gang. A tower erected in this way cost around 400 francs ($16).

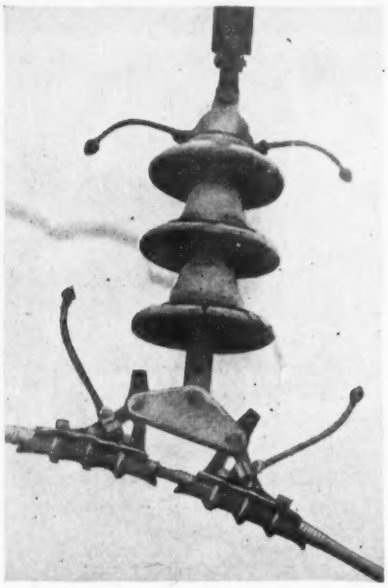
On a 220-kv. German line a contractor used up to four shear poles, each formed by two poles coupled in an A-frame, for swinging 130-ft. towers. One sees that each method has its partisans, though the erection piece by piece requires fewer tools and less space than the swinging method, which is disadvantageous also in wooded or rough countries and often creates in the members excessive efforts of flexion.

Up to 60,000 volts pin-type insulators are much used. Suspension insulators can be separated into three different types, Hewlett, cap and pin, and motor. The

Hewlett insulator is used largely in France because of its low price. Fig. 13 shows a suspension string, with fourteen units, 10½ in. in diameter, for 220 kv. The shield ring, made of 2½-in. steel tube, is galvanized and possesses an aperture permitting its fixation once the conductor is clamped.

In Morocco, for 66-kv., transmission lines formerly equipped with three 11-in. Hewlett insulators, a company was forced to develop a new type of oil-filled insulator that could resist the salt deposits left by the sea winds. A modified Hewlett type was adopted, prolonged at the top by a petticoat bent inside, thus forming a receiver that is filled with oil. As the insulator is not covered the rain enters into the receiver and drives away the oil, so that it must be renewed, but even when the receiver is water filled the insulation is good, and even if the insulator is completely covered with salt the distance between the pin and the petticoat is sufficient to prevent the formation of an arc.





*Figs. 13, 14 and 15—European Varieties of Insulators*

A 220-kv. double suspension string with an 8-ft. safety conductor at a road crossing; special oil-filled insulator unit designed to resist sea salt deposits in Morocco, and a special double clamp insulator string designed to avoid bending cable in Switzerland.

The cap and pin type insulator is universally used and can be had in Germany with strength up to 27 tons. In these insulators the pin is sealed and pressed on a shell placed in the interior of the porcelain. Fig. 15 shows a chain with double clamp in order to avoid bending the cable abruptly because of the large vertical angle.

Recently a new type of insulator has been developed that is in great favor. It is the motor type, in which the insulator, of a lengthened shape, possesses two superposed sheds, or, as in Fig. 1, one lower shed protected by a copper or steel umbrella.

The mechanical strength of such an insulator reaches 20,000 lb. and with lower shed of 12 in. diameter a string of five units, measuring 5 ft. 5 in. long, has a flashover value of 585 kv. dry and 405 kv. with rain. These insulators, of German or Danish make, are more and more used in Italy, Germany and Switzerland.

Insulators of American manufacture are sometimes bought by those who prefer the cap and pin type to the motor type. The Swiss Federal Railways has 132- and 66-kv. transmission lines equipped very largely with American insulators. The latest 132-kv. construction, with seven cap and pin insulators in a suspension string, includes four Swiss-made units at the top of the string and three American units at the bottom.

The elements are nearly always of a brown color, but the Germans prefer green. The white insulators are used only for the distribution systems. Colored insulators are from 5 to 7 per cent dearer than white ones. Glass suspension insulators are very rarely used, but pin type glass insulators are often employed.

### Economics of Conductors

Above 120 kv. solid copper conductors are entirely left aside. Hollow copper conductors have been used on a 220/380-kv. line in Germany, but generally aluminum or aluminum alloy conductors are preferred beyond 120 kv. The A.C.S.R. conductors do not differ from those used in America, but serious vexations are often caused by too long twisting of layers due to incompetent manufacture. Some engineers prefer that all the aluminum layers should be twisted in the same way, stating that the steel core is more protected from dampness. The aluminum alloys, the use of which is beginning to spread, present real advantages compared to A.C.S.R. conductors. Some of these are a reduction of weight, a smaller sag, and lower spans.

Alloy No. 3, manufactured by the Aluminum Industrial Company, Neuhausen, Switzerland, is composed of 0.4 magnesium, 0.5 silicon, 0.3 iron and 98.8 per cent aluminum and has a mechanical strength of 32 kg./mm². It is used in Austria and Switzerland and has been installed on about 350 km. of line in the form of 1,200-km. conductors.

"Almelec," made by the French Aluminum Company, contains 1.2 per cent of silicon and magnesium. Its strength is 35 kg./mm² and its conductivity 54 per cent (copper = 100). It has been used up to now only for distribution lines. "Montegal" and "Aludor," developed in Germany, are also magnesium-silicon alloys, with strength around 33 kg./mm².

A two-circuit, 110-kv. line, 10 km. long with one ground wire, that would cost, with 95 mm² copper conductors, $41,762, would cost $41,752 with "Mon-

tegal." 174 mm². The conductors weigh 29.8 tons in "Montegal," against 53.5 tons in copper, and only 30 towers would be required as against 41 for copper. In fact, the economy would be greater since the right-of-way would be cheaper than for the copper.

With "Alliage No. 3" a 132-kv., 480,000-circ.mil conductor, two-circuit, single-phase transmission line built in 1926 has cost, as compared with the equivalent cost of a 240,000-circ.mil copper line taken as 100: Conductors, 109; steel towers, 84; foundations, 83, and weight of conductors, 61 per cent.

### Ground Wire Installation

The ground wire is fixed in different ways to the tower top. Certain legislation requires that at roads and railroad crossings the towers must be earthed by a 0.31-in. diameter copper wire, joining the earth-plate to the ground wire. The standard tower, however, is earthed by a 4-sq.ft. copper plate, joined to the tower leg by a 0.31-in. copper wire.

The paying out is rarely made by mechanical methods; generally, instead of dragging the drums, the cable is pulled by teams, the drums remaining stationary.

For heavy conductors, or in very rough country, a mechanical paying-out form is used. The author has used with success and with an economy varying from 30 to 50 per cent a paying-out system that requires two winding engines, one at each end of the section. This method, however, can be used only by a contractor having a trained and permanent staff.

The pulling up is done principally by sagging. An easy verification of the sag can be made in the following way: A lineman climbs on one of the towers framing the span on which the sag is to be verified and strikes a strong blow upon the cable with a stick. A vibrating wave runs along the span and is sent back by the next support. One notes the time required for the going and coming of the wave, and the sag in meters is then given by the expression $S = 1.226.\ \theta^2$, where $\theta$ is the duration in seconds of a simple vibration (divide the times found by two).

Direct anchorage when the insulator string is too heavy is dangerous. One proceeds as follows on a 220-kv. line with double strings of fifteen units: The cable, once pulled up, was let down, the strings were fixed to the cable on the ground and the setting up was effected simultaneously by two windlasses, one, very light, lifting up the string end, while the other pulled the cable. If the pulled-up section was very long the cable was temporarily anchored on the tower preceding the dead end and a single span then was let down.

The actual trend is to use as few anchor or dead-end strings as possible. On certain 132-kv. transmission lines of the Swiss Federal Railways there are only four anchor strings on 97 miles of route, at the sending station, at a switching station and at the terminal station. Anchor towers are fitted with five single strings, equipped with suspension clamps, and two strings are vertical and three horizontal, these latter being perpendicular to the cable. It is only in case of a breakage of the conductor in the adjacent span that the five strings support the cable tension.

The transmission methods used in Europe will make the American engineer smile, perhaps. The conditions are very different; for example, often the groundmen engaged in the erection will not go from their homes and they often leave without notice.

# Airport Lighting Requirements*

By H. E. Mahan

*Illuminating Engineer General Electric Company, Schenectady, N. Y.*

THE Department of Commerce requires that an airport in order to obtain the highest ("A") rating for its lighting facilities must have the following equipment: (a) An airport beacon; (b) an illuminated wind-direction indicator; (c) boundary lights; (d) obstruction lights; (e) hangar floodlights; (f) a ceiling projector; (g) landing area floodlighting system. Items (a) to (d) inclusive must operate all night.

The function of the beacon is to mark the airport from distant points. Beacons are generally located either on a steel tower or else on a platform on the roof of a hangar or other building. There are two types of lamps available for use in the beacon, differing in electrical and mechanical characteristics. Both lamps are of 1,000-watt capacity, one operating at 115 volts, the other at 30 volts. Both filaments are in a T-20 bulb with a light center of $4\frac{3}{4}$ in. and a rated life of 500 hours. The beam candlepower with the 30-volt, high-current lamp is approximately 5,000,000; with the 115-volt lamp approximately 2,000,000.

A method of lighting a wind cone consists of four 100-watt lamps in deep bowl porcelain enameled steel reflectors grouped at right angles to each other on 2-ft. arms approximately 6 ft. above the cone. An obstruction light is placed on the top of the assembly. It is customary to operate these lights either from the commercial service in the building or from the boundary light circuit. The extent of the field is made known to the pilot by means of light sources placed around the border of the landing area on approximately 300-ft. centers.

An approved type of unit used for this service consists of a weatherproof housing and etched clear globe inclosing a 600-lumen (60-cp.) 6-6-amp. series lamp or a 25-watt multiple lamp. A recent suggestion of the Department of Commerce recommends that boundary lights surmount a cone 3 ft. in diameter and 3 ft. high, painted in alternate bands of chrome yellow and white, separated by a narrow black band. Obstructions on or in the vicinity of the airport are marked with red lights placed at the highest point of the structure. A beam of light has been found useful in determining the height of ceiling. An incandescent searchlight equipped with a 500-watt, 110-volt, T-20 projection lamp may be used for this purpose. The beam is directed on the clouds at a fixed angle and by sighting at the spot on the clouds from another point the height of ceiling is determined by triangulation.

Whereas the lighting facilities previously referred to follow rather definite regulations established by the Department of Commerce, a wider range of choice is left to the engineer in selecting a system for the actual illumination of the field. The Department of Commerce requires for a field entitled to an "A" rating a minimum vertical illumination of not less than 0.15 ft.-candle over the usable part of the field. This is the illumination measured on a plane of right angles to the field surface and is a measure of the value of illumination incident upon the vertical sides of obstacles, glass, etc., facing the source of light.

**Abstracted from paper presented before second district regional meeting of A.I.E.E. at Cincinnati, Ohio.*

## Meter Reading Instruction for the Public

IN AN endeavor to dispel any impressions entertained by customers that domestic meters are difficult to read and that the company meter reader must be accepted as infallible, New Orleans (La.) Public Service, Inc., recently instituted a new activity.

Several watt-hour meters were installed in the commercial offices of this utility and a trained meter reader with winning ways was detailed to explain the method of reading to interested visitors. A booklet "How to Read Your Meter" was distributed to those taking advantage of this educational opportunity. Advertisements in the newspapers and trolley cars acquainted the public with this innovation, as did stickers attached to the bills for monthly service.

*Meters and Instructor Educate Public in Meter Reading Procedure*

So satisfactory were the results of the endeavor that, according to J. C. Barnes of New Orleans Public Service, Inc., customers' meter-reading service may be inaugurated again in order to afford new customers the same opportunity to acquire this information that present ones have enjoyed.

## Commercial Cooking Attractive At 3 Cents

MORE than 4,000 hotels, bakeries, restaurants, hospitals, etc., are today using heavy-duty electric cooking equipment, according to a paper by Roger P. Loud of the Boston Edison Company before the New England Association of Central Station Power Engineers. With the electric bake oven installed in decks with separate temperature control different products can be baked simultaneously, such as bread at 450 deg., pies at 375 deg. and fruit cake at 300 deg. F. Recent Boston installations include four 22-kw. ranges at the Copley Plaza Hotel, 80 kw. in cooking apparatus at Filene's store and two ovens at the Boston Chamber of Commerce. An all-electric kitchen of 200 kw. rating is provided for the new U. S. Veterans' Hospital at Bedford, Mass. In the thirteen years that the Boston Edison Company has sold bake ovens not a single burned-out unit has occurred. An electric oven at the Newton Hospital has operated more than 10,000 hours without a service call. The load of such ovens is well off the lighting peak, the baking period being usually from early morning to about 10 a.m. After the initial preheating, even with bread baking, the average operating demand is but 60 per cent of full rating.

As a source of revenue, the Boston company finds that on an average rate of 3 cents per kilowatt-hour the income is about $50 per year per kilowatt of connected load. This applies equally well to ranges, broilers, large toasters, waffle irons, griddles, etc. Assuming a life for the equipment of twenty years, every 500 kw. added in this class of business means $25,000 per year, or $500,000 of revenue for the assumed life of this load-building apparatus.

## Iowa Lines Serve 99.7 per Cent of People

THE Board of Railroad Commissioners of Iowa, according to Joe Carmichael, director of the Iowa Committee on Public Utility Information, reports that during the year between Dec. 2, 1927, and Dec. 1, 1928, 2,582.7 miles of transmission lines outside of cities and towns were covered in franchises authorized either by the board or by county supervisors, an unprecedented record in the state.

Only 24 towns in Iowa out of the total of 922 do not have electric service. The average population of these towns is 133 people. Four towns were connected up with transmission lines and secured service for the first time during the past year. No town, it is needless to say, abandoned service. Iowa maintains its position as being probably the most completely electrified state in the country so far as its cities and towns are concerned. Of the 1,401,762 people residing in the state, 1,398,567 have electric service available, or 99.7 per cent. A recent survey shows that 13,817 farms are getting service from central-station companies and that about 14,000 individual farm-lighting plants are also in operation in the state. This makes a total of 27,817 farms which are using electricity to a greater or less extent.

| | Miles |
|---|---|
| **Franchises by the commission:** | |
| Rural supply lines, 2,300 and 6,600 volts | 680½ |
| Other supply lines operating at 2,300 and 6,600 volts to serve town and industry | 194½ |
| Lines operating at 11,000 and 13,200 volts | 118½ |
| Lines operating at 33,000 volts | 327½ |
| Lines operating at 44,000 volts | 9 |
| Lines operating at 66,000 volts | 88 |
| Total mileage granted by commission | 1,494.70 |
| **Authority to increase voltage of transmission lines:** | |
| 6,600 to 33,000 volts | 7 |
| 13,200 to 22,800 volts | 53 |
| 13,200 to 33,000 volts | 11½ |
| **Authority to attach additional circuits:** | |
| 6,600 volts | 53 |
| 2,300 volts | 5 |
| 33,000 volts | 4½ |
| **Franchises by the supervisor:** | |
| Mileage in franchises granted by the various county boards of supervisors for 6,600 and 2,300-volt lines | 985½ |
| For 13,200-volt line | 1 |
| For 33,000-volt line | 1½ |
| Total granted by supervisors | 988 |
| Grand total of mileage covered in franchises | 2,582.7 |

# Making Rubber Gloves Safe

General characteristics of rubber and its compounds. Specifications and tests for rubber gloves. Dielectric and mechanical characteristics of gloves

By Murray F. Skinker
*Assistant Director of Research Brooklyn Edison Company*

RUBBER is usually obtained by the coagulation or evaporation of latex, a slightly pink, milky juice from the bark of certain trees, and contains small quantities of resins, proteins, sugars and mineral substances. Pure rubber is a hydrocarbon and, strangely, has the same ratio of hydrogen and carbon as turpentine, $C_{10}H_{16}$, but with different chemical bonding. Since both carbon and hydrogen have a great affinity for oxygen, it is obvious that rubber will be susceptible to oxidation. For most work rubber must be made into compounds and is masticated into a plastic with which is mixed sulphur, fillers and accelerators.

Sulphur in one form or another is essential to most vulcanization. Without it the masticated rubber would become sticky and never regain any of its so-called elastic properties. The fillers are of two kinds—organic and inorganic. The organic fillers are paraffine, pitch, resin, tar, linseed oil (in various forms) and mineral rubber. The inorganic fillers are whiting (French chalk), barytes, lithopone, zinc oxide, antimony sulphides, mercuric sulphide (vermilion), ferric oxide, clays, slate flour, graphite fossil flour, lamp-black, gas-black, etc.

The physical and electrical properties are greatly affected by these fillers. Some of the inorganic fillers are not insulators and there may be conducting impurities in all of them.

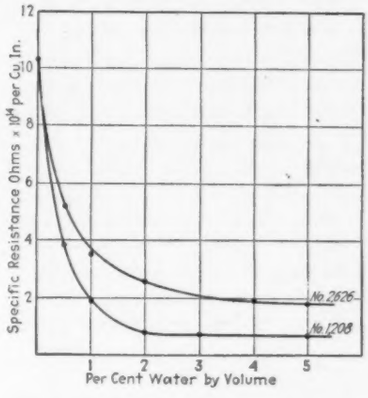
Accelerators are added, as the name implies, to shorten the time of vulcanization. They may lower the vulcanization temperature and some may improve the mechanical properties of the rubber. Their action seems to be catalytic because very little is required.

### Vulcanization Accelerated

Examples of accelerators are litharge, calcium hydrate (slaked lime), magnesium oxide and selenium oxide. Besides these mineral accelerators, a large number of organic compounds are used for similar purposes.

These materials—rubber, sulphur, fillers and accelerators—are thoroughly mixed in varying percentages to get the particular characteristics desired after vulcanization. The exact percentages and materials used by different manufacturers may well be called a trade secret and each manufacturer has to vary the proportions according to the cost and purity of the ingredients. Vulcanization consists in heating to a proper temperature, usually below 160 deg. C., in steam or dry air. There is another type of vulcanized rubber known as acid-cured. This vulcanization is accomplished without heat by the use of sulphur monochloride, $S_2Cl_2$, used either as a gas or in solution.

Rubber is subject to deterioration. Dielectric deterioration will occur through the action of sunlight, corona or ultra-violet light in producing ozone. Heat will also aid oxidation. Mechanically tough rubber usually contains about 60 per cent rubber and the best electrical rubber usually 30 per cent. Actually, the percentage of rubber given above does not define the characteristics of the compound. Some manufacturers have made rubber compounds of 25 and even 20 per cent which have as high breakdown values as good 30 per cent (450 volts per mil thickness) and have gained improved aging characteristics. In general, it may be said that the less rubber the more stable the compound. The best electrical rubber, because it is not mechanically tough, must be protected by a lead sheath, mechanically tough rubber jacket, or a braid of suitable material. The specific resistance of any rubber compound varies greatly with the amount of absorbed water. Vulcanized rubber may absorb as much as 500 per cent water, though usually only 8 to 35 per cent. Even 2 per cent moisture very seriously weakens the rubber. And of course the surface resistance, which is also of very great importance to rubber gloves, is affected even more than the volume resistance. Oxidation is greatly accelerated by mechanical strain; so, also, the dielectric strength is lessened by mechanical strain.




*Relation of Moisture Content to Specific Gravity*

Rubber gloves were first manufactured by vulcanizing together flat pieces and strips of rubber and these gloves were repaired by vulcanized patches. Today the usual glove is manufactured by the "dipping" process. A rack holding several porcelain forms, in the shape of a forearm and hand, is dipped into a solution of the rubber. The solvent is a volatile oil and the rubber has with it the necessary fillers, sulphur, etc. Care must be taken to keep the solution thoroughly mixed between successive dips. The dips are 15 to 25 in number, depending on the thickness desired. Since each layer must be thoroughly dried before the next dip, only two to five dips can be made in a day. Therefore, it takes three to ten days to make each glove. Following inspection, the bead on the cuff is made by rolling up the edge. The gloves are then vulcanized on the same forms.

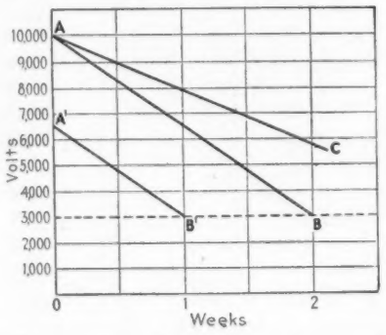
This may seem simple, but there are many things to worry about. If the dips are not made just right ridges will be formed by the rubber when it runs, bubbles may

be trapped between successive layers or the glove may be thicker at one end than at the other. Any of these things may be sufficient to make the glove unfit for use. There is trouble with the solvent boiling on humid days, the gloves from different parts of the rack may not be uniform because the outer ones dry faster, and there seems to be no end of other possible difficulties.

The average thickness of gloves used by electricians today is about 50 mils on circuits of 3,000 volts or less. This means a stress of not over 60 volts per mil, compared with 450 to 600 volts per mil for the best electrical rubber. It is well that this stress is low because the glove must receive severe mechanical use and the manufacturer must use a rubber mechanically tough instead of the usual electrical material.

The only specification for electricians' rubber gloves in general use in this country is the American Society for Testing Materials "standard specifications for rubber gloves for electrical workers on apparatus or circuits not exceeding 3,000 volts to ground." This specification has been adopted by the United States Federal Specification Board for use in all government departments. These are purchase specifications and were written by a committee made up of approximately equal numbers of representatives from manufacturers and users.

The specifications require the manufacturer to pack the gloves in individual boxes for protection and to mark each glove with the manufacturer's name. The gloves must be tested within two weeks of day of receipt by purchaser. It is required that the transformer used in testing must give approximately a sine wave and the thickness gage used must have certain definite characteristics.




*Rate of Deterioration of Gloves Must be Periodically Tested to Determine Suitability*

If A'B' represents maximum rate of depreciation, then 10,000-volt test would insure a safe glove on 3,000 volts up to two weeks.

The physical inspection is the most debatable part of any specification. The specification reads, "Gloves shall be free from patches, blisters, pinholes, cracks, protuberances, imbedded foreign matter or other physical defects which can be detected by thorough surface inspection." The words "or other physical defects" can be interpreted in many ways. However, I have seen fourteen selected gloves submitted to four independent laboratories. The gloves all had possible defects. Two laboratories rejected all but three and the others rejected all but two; this is very good on such a debatable question. A good practice is to first ask. "Is the defect weaker than the rest of the glove?" If it is, that throws it out. Then if not, "Will the man who uses the glove think it unsafe?" If so, it must be rejected because he must have confidence in what he uses.

After the purchase of good gloves it is necessary to retest them at intervals so that defective ones may be taken out of service. The inspection and electrical test must be rigid enough and the period short enough so that the gloves will be brought in before they become hazards. Theoretically, one can take the maximum rate of deterioration and from that determine the time and electrical test. One has to be guided by the safe value for the slope of the deterioration curve by experience. The gloves must receive a very thorough physical inspection each time and all with perceptible defects thrown out. The oxidation of the glove must be watched and can be detected by pulling the rubber slightly.

The usual electrical test is 10,000 volts. This should be applied for one or more minutes. A great majority of the failures usually occur in the first minute. The necessary time can be determined by testing for a longer period, say five minutes, and keeping a record of those failing each minute. Then the time should be so chosen as to include at least 99 per cent of the failures. A fraction of a per cent may have to be left, because if the test is continued too long there is danger of the water in the testing tank reducing the resistance of the glove and causing breakdown.

So far as I know there is no record of any one being killed due to a defective glove. It is well to avoid, so far as possible, the use of gloves on low voltages, such as 110-220, because the men do not feel that these are necessary and will abuse the gloves. An injured glove is a greater hazard than no glove at all.

Many users of gloves have found special containers for each pair an advantage. The best type is one which does not permit the glove to be crushed and keeps out light and ozone. Crushed gloves soon crack along the edges, and gloves available for use at stations must be protected from light as well as ozone.

### Containers Reduce Consumption

At the same time that the Brooklyn Edison Company adopted the use of gloves, it also provided containers. The saving in the purchase of new rubber gloves in one year was 1,000 pairs. This saving in dollars was approximately equal to the salary of the two men who did the entire testing of both old and new gloves for that year. After this company first started to use specifications for electricians' gloves, of the first 1,000 gloves received it was necessary to reject 25 per cent. Two years later the rejection had reduced to one-third of 1 per cent for the last 1,000. At present the company's purchases amount to more than 2,000 pairs per year and the total retest last year was 40,000.

It is advisable to stamp the date on each glove when it passes a retest so that it can be checked in the field. If the glove is in a sealed container the date should appear on the outside also. It is well to keep a record of every test on each glove. This will make it possible to see that gloves are properly returned for testing.

Through a co-operative program of an American rubber manufacturer and the Brooklyn Edison Company gloves have been furnished which on preliminary tests indicate general superiority over the gloves on the market at present. Some of the advantages of this new type of glove are indicated by the following comparison against two popular types of gloves:

| | Per Cent Better |
|---|---|
| Tensile strength | 250 |
| Elongation | 40 |
| Tear resistance | 1,000 |
| Abrasion | 15 |
| Aging | 300 |

Out of 24 of the large companies in one state about one-fourth made no acceptance tests and about two-thirds do not make adequate retests. So there is plenty of room for more testing.

# *Eight Major Trends in*

# Steam Turbine Design*

Larger units and higher pressures rapidly gaining favor. Hydrogen cooling promises success. Field of mercury vapor process

By ELMER SMITH
*District Turbine Specialist General Electric Company, Boston, Mass*

THE most marked trends in steam turbo-generator design at this time appear to be eight in number: (1) Higher operating steam pressures; (2) larger single and group units; (3) reduction in heat rejected to the condenser by use of extraction steam for heating feed water, combustion air and reheating steam in the main unit; (4) return to multiple valve inlet steam control; (5) the almost universal use of non-condensing and extraction turbine units, making these more and more automatic; (6) cooling generators by hydrogen with self-contained coolers, making outdoor installations feasible; (7) the use of direct-connected shaft generators on large units for driving auxiliaries, and (8) the superimposition of the mercury cycle on the steam cycle.

In amplifying these different headings it is very interesting to know that our company has at present in operation and on order 373,650 kw. of turbine units primarily intended for the use of 1,200-lb. steam. This tabulation does not include units such as the larger ones in the Edgar station at Weymouth, which take some of their steam directly from 450-lb. boilers, and includes only units taking all of the steam in at approximately 1,200 lb. pressure.

There is no doubt whatever but that the future tendency will be to use pressures at least as high as 1,200 lb. on large size installations, and it is probable that even higher pressures will become common as soon as more operating experience is obtained at 1,200 lb. pressure. As a general rule the higher pressure stations will apply particularly to large plants with high-priced coal.

The latest A.S.M.E. steam data show that the saturation temperature at 3,200 lb. pressure is approximately 705 deg. F., and as saturated steam expanded in a power unit approaches more nearly to the ideal steam cycle than does superheated steam, it naturally follows that for a given total temperature the cycle efficiency will be higher with the higher pressure.

### 1,200-Lb. Units No Longer Novel

It is generally agreed by those who have had experience with 1,200-lb. plants that no material difficulties attributable to the pressure have been encountered and today our company will install a 1,200-lb. turbine with exactly the same assurance of successful operation as at 400 lb.

Our engineers feel that where designers are free to adopt ideal conditions they would today recommend 1,200 lb. gage pressure and 750 deg. F. at the turbine throttle, reheating at around 350 to 400 lb. back to 800 deg. F., as the gain from increased temperature is greater on the reheat than on the initial steam.

### Striking Fuel Economies Within Reach

A turbine of 100,000 to 125,000 kw. size with these operating conditions and 1-in. absolute back pressure will show at its best point considerably less than 9,000 B.t.u. per kilowatt-hour chargeable to the turbine, and this with 6 per cent allowance for the operation of station auxiliaries and with 85 per cent over-all boiler room efficiency will show less than 11,000 B.t.u. per kilowatt-hour for the complete station, representing a thermal efficiency of better than 31 per cent. With 14,500 B.t.u. coal this is equivalent to 0.76 lb. coal and with 19,000 B.t.u. oil it is equivalent to 0.58 lb. oil per kilowatt-hour.

It is the belief of our engineers that there is little to justify the consideration of 600 lb. pressure on large central-station plants because the plant costs more than a 1,200-lb. plant, and as compared with a 450-lb. plant the gain in total power cost is entirely in favor of the 1,200-lb. installation.

Our company has installed and on order approximately 1,250,000 kw. of turbine units for approximately 600 lb. pressure and we are confident that no one should consider such plants as representing poor design, because they were an absolute essential intermediate step which had to be taken beyond the standard 450-lb. plant before the art could progress to the 1,200-lb. point.

One of the chief factors in the 600-lb. plant compared with 1,200 lb. is that at 600 lb. standard 450 fittings cannot be used and the maximum allowable throttle temperature is such that the steam has to be reheated, thus involving all of the special features of a 1,200-lb. plant without a commensurate economy gain.

The demand for larger units has been very insistent and had led to the construction of a single generator of 160,000 kw. with a tandem compound turbine and a triple unit of 208,000 kw. combined capacity. A triple unit of 400,000 kw. has recently been laid out, which in this particular instance has demonstrated that considerations other than the limits of manufacture will frequently determine the maximum size of unit to be installed.

There is every reason to believe that 1,200-lb. units of 125,000 kw. would require no greater floor space for the same installed capacity than would a plant with the 400,000 kw. triple units for 600 lb. pressure. A 1,200-lb. unit of 125,000 kw. is cheaper per kilowatt than is a 400-lb. unit, because the 400-lb. unit would naturally be a tandem compound with double-flow low-pressure element,

**A discussion presented before the Boston section of the American Society of Mechanical Engineers.*

all running at 1,800 r.p.m., while the 1,200-lb. unit of this size would naturally have the high-pressure section separate at 3,600 r.p.m. and the low-pressure section could be single flow at 1,800 r.p.m. Generators of these larger sizes have been wound for direct generation at 22,000 volts. This is at times necessary in order to keep the current capacity within the designed limits of circuit breakers, but should not be considered as essential in all cases because the increased first cost compared with the standard 14,000-volt unit is quite material and the gains might not justify the cost.

Turbines at 3,600 r.p.m. are available today in sizes at least as large as 18,750 kva., and it is quite probable that shortly a 25,000-kva., 3,600-r.p.m. machine will be available.

Some of the larger units have four and five bleed points for feed water heating, but these are exceptional and in the great bulk of cases three extractions are sufficient.

By 1930 the company will probably have shipped a total of nineteen resuperheating units averaging approximately 60,000 kw. size.

It is frequently difficult to place air coolers beneath the generator, and as the generator is always narrower than the turbine it is entirely feasible to place the air coolers beneath the generator lagging and above the floor line without objectionably increasing the width.

The 160,000-kw. triple unit at Philo, Ohio, is now being installed and the 208,000-kw. triple unit at the State Line station is being installed and should be in service by or soon after June 1.

It is difficult for some to understand how a gain in economy can be secured by extracting steam after it has passed part way through a turbine instead of allowing it to go all the way through. This is because each pound of steam that goes through to the condenser rejects nearly 1,000 B.t.u. to the condenser circulating water. If instead of condensing this steam it is extracted and used for heating water, steam or air for power plant use, the heat units represented by the latent heat in the steam are returned to the generating cycle, thus readily explaining the reason for the gain.

### Multiple Valves at Inlets

Years ago all of the moderate and large sized turbines made by the General Electric Company used multiple valves for controlling the admission of high-pressure steam. For a time after the operating pressures had been increased to 400 lb. and the size of units had been greatly increased it was felt that large central-station units would be operated at constant full load and, therefore, single throttling valves would be satisfactory, and, furthermore, it was feared that operating difficulties might be experienced with the multiple valves at the higher temperatures. Experience, however, has shown that in the first place very few units are operated at constant load even when first installed, and in the second place the small valves can readily be made suitable for the higher temperatures. The tendency, therefore, is very strongly toward the use of a considerable number of valves to control the high-pressure steam inlet so that the governing will be done without throttling. The reason for the loss in economy at partial loads on a unit with a throttling governor is frequently not understood because of the fact that the steam after passing through the throttling valve contains just as many heat units as before throttling. The fundamental reason for this loss is that after being throttled the steam starts through the expansion cycle at a higher entropy than had it not been throttled, and the higher the entropy for a given constant exhausting pressure the greater will be the amount of heat rejected in the exhaust. Therefore, with equal heat at the beginning of the expansion cycle the available energy is less at the reduced pressure incident to the throttling governor.

It is frequently argued that where the exhaust steam is used for manufacturing process work this is not objectionable, as the heat is recovered in the process work. The fallacy of this argument is easily shown by the fact that the primary object of installing the generating unit is to produce electrical output, and as this output is reduced for a given steam flow by the use of a throttling governor this principle of governing may frequently make the use of such a reducing valve type of turbine generator unit entirely inadvisable, whereas for exactly the same operating conditions a turbine unit with a non-throttling governor would be a good paying investment.

Non-condensing units for supplying process steam are frequently provided with a back pressure governor which uses the pressure in the exhaust pipe mechanically to open and close the steam inlet valves, so that the amount of steam passing through the turbine exactly follows the demand for manufacturing process steam and maintains a predetermined pressure in the low-pressure steam system. Such a turbine will produce from the process steam the maximum possible kilowatt output, and with fluctuations in process steam demand the variation in electrical output must be taken care of by operating such units in parallel with purchased current, waterwheel units or condensing turbine units of such total capacity as to be able to take the swings.

### Interconnection with Industrial Plants

This type of unit has been available for a number of years. We believe substantially all New England central stations today recognize the fact that in plants requiring process steam it is to their advantage to allow such reducing valve type turbine units to be operated in parallel with their system as it offers a ready means of building up their power load.

Recently a number of quick-starting non-condensing units have been furnished for large central stations which were intended to stand idle the great bulk of the time, but which were so arranged that they could be started by a push button and be up to speed and voltage in approximately ten seconds ready to drive the station auxiliaries. The units sold range in size up to 5,000 kw. and are justified on systems with long transmission lines or on large-sized systems where the station auxiliaries are driven directly from the main generators.

Low-voltage generators coupled to the shaft of the main unit for driving station auxiliaries are being used in a very large number of present-day plants. In this way the operation of the station auxiliaries is kept separate from the main transmission system, the effective size of the main generator is not reduced as it is when the auxiliaries are driven from the main generator and such a shaft generator can be installed without increasing building dimensions because the space required for drawing the field of the main generator is always longer than the house service shaft generator with its exciter.

### Output Increased by Hydrogen Cooling

The use of hydrogen for cooling turbo-generators has proved itself and no doubt will be largely used, inasmuch as this system of cooling allows approximately 25 per

cent greater output from a given frame and experience has shown that it constitutes no element of danger. Such generators are arranged with perfectly tight casings except for the packing joint around the shaft where special arrangements are made to prevent leakage. The hydrogen cooling elements are built right into the generator so that it is at the present time entirely feasible on hydrogen-cooled units to place at least the generator entirely outdoors. It is even conceivable that in the future, units with hydrogen-cooled generators may be placed entirely outdoors so that no housing will be required.

### Field of Mercury Process

The proving out of the mercury cycle has progressed very slowly, but operating results obtained on the 10,000-kw. unit have shown very gratifying performance. The principal reasons for the fine economy of the mercury unit when superimposed on top of a steam cycle are, first, the fact that it operates at something over 100 deg. higher temperature than most of the present-day steam plants, and, secondly, because the high saturation temperature of mercury vapor allows these high temperatures without material superheat, and this, together with the very low specific heat of mercury vapor, causes the high efficiency of the mercury cycle. The great need in the development of the mercury and steam cycle for central-station use is to be able to offer mercury outfits of the size required by present-day central stations.

The 10,000-kw. mercury turbine produces approximately 125,000 lb. of steam per hour and even the most efficient steam turbine would not generate more than 15,000 kw. on this amount of steam, so that the largest complete mercury steam unit that is available today is approximately 25,000 kw., whereas the demand by central stations is for units of 50,000 to 150,000 kw. sizes.

Our engineers believe at the present time that the use of the combined mercury steam cycle will be quite generally confined to large plants operating at a high load factor with expensive fuel, and it is doubtful if the mercury cycle will be advisable for moderate- and small-sized plants for some time to come; that is, until the natural progress of development will materially reduce the first cost.

## Utility Finances and Maintains Electric Signs*

By C. R. Tracy
*Sioux City Gas & Electric Company, Sioux City, Iowa*

A SURVEY recently conducted in Sioux City in which 482 signs were investigated showed a total in empty sockets of 48 kw., or approximately 100 watts per sign. Assuming an average of four hours burning per night at a rate of 6 cents per kilowatt-hour, this is a direct loss of $24 per sign per year. It was also found that 96 signs, or about 20 per cent of the total, were not used regularly. This may sound startling, but is a direct indication of the condition that signs will get into when proper attention is not given. Two per cent of the total signs were not connected, two of them in particular had not been used for four or five years and maintenance agreements were secured for them. These two signs represent an estimated recovered annual revenue of $619 for energy alone.

The average sign manufacturer extends only three to four months' credit to first-class risks and many firms hesitate to make a large investment in electrical advertising because their budgets do not permit the spending of such large amounts in so short a period. Most utilities can finance signs on a profitable basis without adding direct profit to the cost of a sign. The Sioux City Gas & Electric Company does, and although its plan has been in operation only a short time some quite elaborate displays are being planned by local merchants.

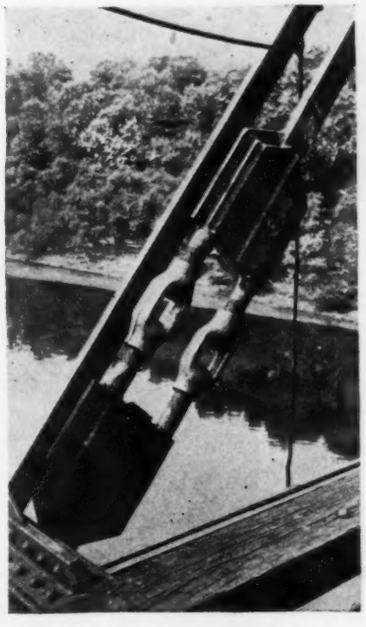
The monthly billing amounts for a sign purchase contract are obtained by dividing the price of the sign installed by 12, 24 or 36, depending on the amount of the contract and the credit standing of the customer. The "price of sign installed" includes: Cost of sign delivered, cost of hanging and cost of wiring and connecting plus a small overhead charge; complete filling of lamps at a discount from list; time switch, flasher, etc., at list prices; maintenance service, including painting, lamp renewals, inspection and cleaning; carrying charge of three-quarters of 1 per cent of the total of the foregoing items. When the sign is paid for the contract continues on a maintenance basis alone.

*Abstract of paper presented before operators' convention, Iowa Section, N.E.L.A.*

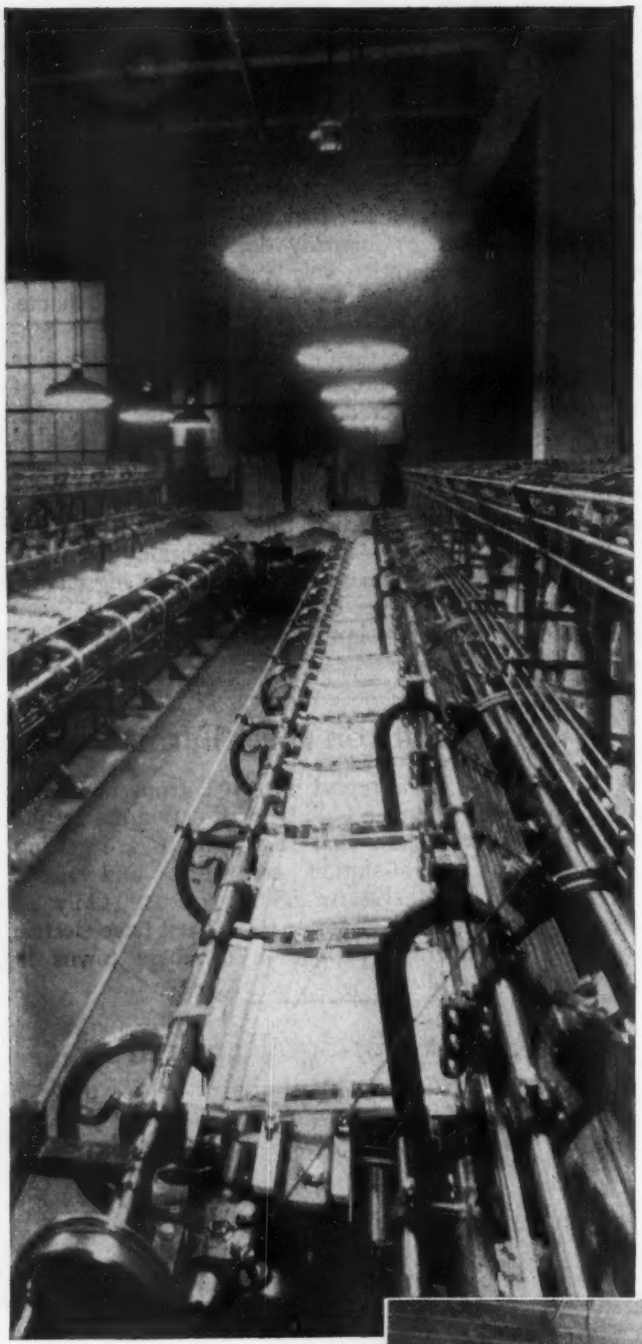
## Electricity on Iowa Farms

ACCORDING to a report received from the Iowa Committee on Public Utility Information the results of a recent survey show that 13,817 farms are getting service from central-station companies and about 14,000 from individual farm-lighting plants. Only 24 towns in Iowa out of the total of 922 do not have electric service. The average population of these towns is 133 people.

## Railroad Bridge Repaired by Arc-Welding



THE elongation of the eyebar diagonals in the three spans of the pin-and-link type, through truss structure crossing the Kiskiminetas River near Pittsburgh, Pa., necessitated adequate repairs. The inactive members were drawn up to carry their full share of the dead and live load stresses. This was accomplished by a device consisting of two turnbuckles welded to plates attached to the inactive bar, drawn tight with clamps and permanently attached by welding. The results, which are said to be highly satisfactory, were secured through the use of General Electric welding equipment by the Pittsburgh Welding Corporation and indicate an acceptance of welded construction for tensional stresses of exceedingly violent character.



# When Daylight Needs Help

By Arthur A. Brainerd

*Illuminating Engineer*
*Philadelphia Electric Company System*

ARTIFICIAL light properly installed can bring tangible benefits to almost all operations, which are not entirely automatic, not only on night shifts and dark days but even under the most favorable daylight conditions. In the "knitters" manufacturing full-fashioned hosiery at the Realart Silk Hosiery Company, Lawndale, Philadelphia, a striking example of this was encountered.

The knitting room is about 100 ft. by 60 ft. with a 14-ft. ceiling. About 25 per cent of the wall space is window area and the ceiling and walls are painted white. The machines are placed back to back in pairs separated by a 3-ft. aisle and perpendicular to the window.

Preliminary stop watch studies showed that it took each machine about 45 minutes to knit eighteen stockings. Of this time 24 per cent was spent in close manual work with the machine stopped while the operator did the "topping in"; that is, folding back the top when a few inches had been knitted and placing the seams on the needles. The work is trying, requiring a high degree of skill and quick, accurate vision. Every seam must go on its proper needle or the stocking becomes a "second." The needles are fine and close together and the highly polished surface causes severe specular reflections.

It is impossible to light the operation satisfactorily by means of one row of lighting units for two machines, if a

*Improvement in lighting conditions as result of study of distribution, intensity, surface characteristics, shadows, etc. Several trial installations were made.*

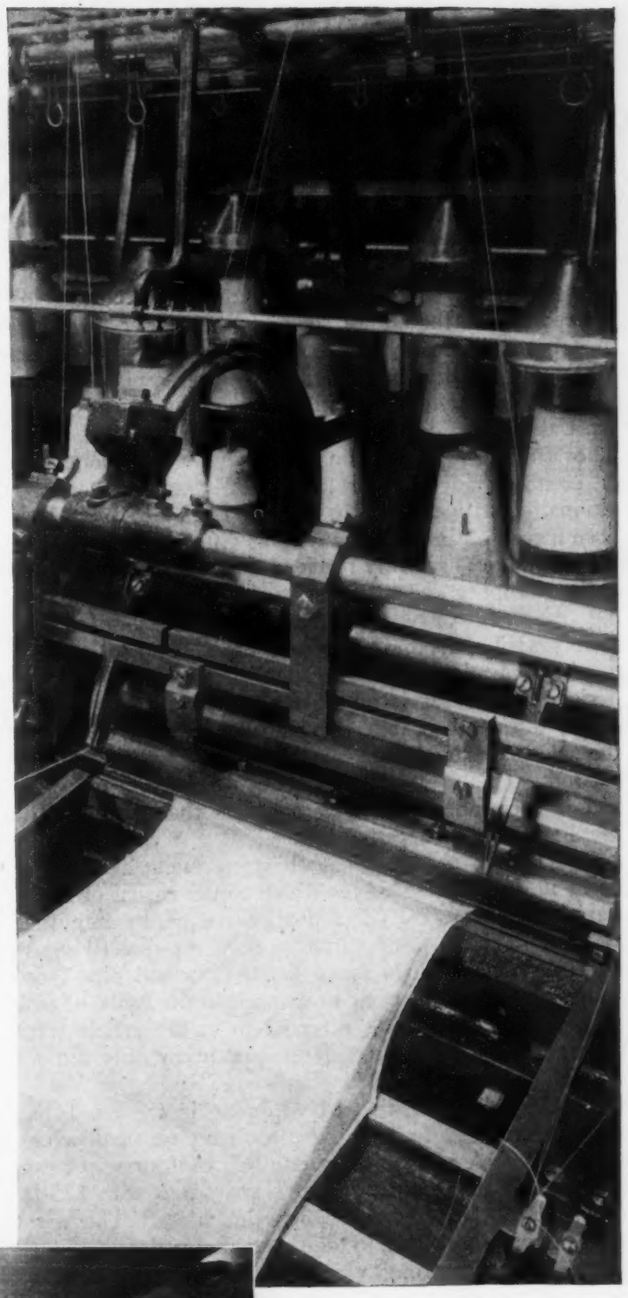
direct lighting system is used. The height and character of the ceiling make high-intensity, indirect lighting out of the question.

The existing arrangement, consisting of a row of six shallow dome reflectors mounted 10 ft. in height between each pair of machines, was utterly inadequate. The average foot-candle intensity was 7.2 and the variation factor 2.2. After a preliminary survey it was decided to work with an experienced operator until a system of lighting as near correct as possible was secured and then study its effect on production.

The system finally decided upon consisted of four "RLM" dome reflectors with 200-watt bowl-enameled lamps evenly spaced over each machine. Careful studies seemed to indicate that the best position was 8 ft. above the floor directly over the front of the machines and not over the needles. This produced the fewest shadows and glare at the needles and gave an average intensity both on the vertical and horizontal planes of 17.5 foot-candles. Both "RLM's" and "glassteel" diffusers were tried for six weeks under identical conditions and no measurable difference in performance could be detected.

When the final set-up was decided upon a careful comparison was made of production under both old and new systems, the records studied covering a period of over six months. This showed an average increase in production on the night shift of 5.8 per cent and a similar increase in production of 3.9 per cent on the day shift.

That is remarkable, especially on the day shift, when we consider that in order to accomplish it it was necessary to speed up the manual operations 16 per cent. This was accomplished in the late spring and early summer in a factory that had exceptionally good natural illumination. Undoubtedly this increase was due to elimination of the slight shadow caused by daylight coming largely from a horizontal direction.



*Needle-point illumination presents a difficult problem. Comparative tests of "RLM" and "glassteel" diffusers indicated no difference in performance.*

# Letters from Our Readers

## *Dancing Cables*

*To the Editor of the* ELECTRICAL WORLD:

I have read with a great deal of interest the article by W. K. Archbold in the January 26, 1929, issue of ELECTRICAL WORLD on "Dancing Cables" and hope that it may result in an exchange of experiences by more companies that have had similar trouble. The dancing as reported by the author seems to fall under three distinct heads; probably the first, which he calls "resonant vibration," is the most common, as certainly it is the most frequently encountered on the system of the Southern California Edison Company. This is the kind which takes the form of standing waves with quiet nodes at different distances apart under different weather conditions. Half wave lengths varying from 7 to 39 ft. have been measured in the same wire at different times.

A report was recently received that a certain composite cable of copper and bronze 1 in. in diameter was jumping 3 in. A test showed that while the vibration was plainly visible from the ground the cable was actually moving only ¾ in. at the peak of the wave. An inexperienced observer is apt to add the width of the blur at the top of the cable, the blur beneath the cable and the width of the cable and call it the amplitude of vibration. This gives a result about three times too great and is mentioned here to emphasize the necessity for more accurate observation.

The Edison company has charts showing a vibration of 1¾ in. in standing waves which to the casual observer were visible for 200 yd. and appeared of an amplitude of 6 in. This form of vibration does not directly cause interruption, but does shake bolts, nuts and pins loose and may ultimately result in damage to the cable. Some of the cases of dancing referred to in the article were apparently of this nature. Just how many only a more careful observation would show.

The second form, that of whipping in the wind, has been experienced by the Edison company on small wires, principally. A private telephone line of four wires was built over a mountain range two years ago with 125-ft. spans and 14½-in. clearance between wires. The wires were strung very slack, to take care of sleet loading, with the result that strong winds blowing up the canyons wrapped the wires together in numerous places and had to be shaken out by patrolmen. Part of the slack was pulled out of the wires and no further trouble, either from wrapping together or sleet loading, was experienced.

The only case of trouble reported on a power line from this cause was on a 1,200-ft. river span of No. 1 copper strand with 10-ft. horizontal clearance between wires of the single circuit. Two of these wires whipped together in a heavy windstorm and burned down.

This was a bad exposure, 200 ft. high across a canyon, but after this cable was changed to No. 3/0 copper no further trouble was experienced. This company has never experienced trouble from whipping cables as a result of sleet, but anything which, like sleet, increases the exposed surface without proportionately increasing the weight, might be expected to produce that result in cables which were already too light for the wind to which they were exposed.

The third form of dancing to which the author refers, that of jumping from unloading sleet, is probably the most serious and difficult to control.

The sleet troubles of the Southern California Edison Company are limited to one line, a No. 4/0 copper double-circuit tower line with 10-ft. vertical clearance between wires and 3 ft. horizontally. The wires build up to 4 in. in diameter with snow and sleet, and if the bottom wire unloads first with a cross-wind blowing it is almost certain to jump up and make contact with the wire above. The 3-ft. clearance horizontally is not sufficient to make up for the difference in the blow-out angle of the loaded and unloaded cables. Observations taken during such a storm indicate that a 10-ft. horizontal clearance would not insure against accidental contact in a 1,200-ft. span. The obvious remedy is to set intermediate towers, but the contour of the country does not lend itself to this solution.

G. H. STOCKBRIDGE,
Transmission Engineer.
Southern California Edison Company,
Los Angeles, Calif.

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## *"Curling Irons and Bobbed Hair"*

*To the Editor of the* ELECTRICAL WORLD:

The editorial on page 575 of the March 23 issue of the ELECTRICAL WORLD dramatizes the total sales of heating appliances from the standpoint of the housewife's varying interest. The manufacturers of these appliances, of course, are keenly interested in analyzing these new U. S. Census figures of 1927 compared with 1925, which, though they apply to the year before last, are very useful in furnishing revised bases for present forecasts, as well as for seeking out the commercial possibilities and limitations of these appliances.

In looking over the complete list of census items, the percolator, toaster and waffle iron stand out strikingly as showing very distinct and substantial gains. In fact, they about doubled, as your editorial also indicates.

It is significant to me that these gains can be correlated with the N.E.L.A. concurrent advertising campaigns; in fact, I think there can be no evading it. The concurrent campaigns have been built especially around these three appliances, which before had achieved only a small saturation. The concurrent campaigns have not only greatly increased the saturation point but have given central stations and manufacturers business in what would otherwise be dull months. Also, there has resulted increased consumer acceptance for these appliances.

It is the experience of the manufacturers that the gains on these three items have continued since 1927, largely due, no doubt, to the concurrent campaigns.

The fly in the ointment, however, regarding these campaigns is that, on the whole, they have been unprofitable in themselves from the standpoint of the manufacturers. Unnecessarily have central stations looked for cut prices rather than constructive sales promotion and have placed an undue burden on the manufacturers for sales promotion service. There has also been stirred up an undercurrent of local dealer dissatisfaction because these campaigns have not usually been worked out in harmony with N.E.L.A. principles of merchandising. With these things sweetened up, not only will the manufacturers be compensated and encouraged to greater efforts, but the concurrent plan should move forward with broader and increased activity to the advantage of the central stations, in substantially increasing their domestic appliance load.

H. J. MAUGER,
National Electrical Manufacturers' Association.
Chairman Heating Device Section.

# Digest of Electrical Literature

## *Hydro-Electric Development and Steam Equipment*

*Lakefield Plant Uses Movable Blade Turbine.*—H. R. McClymont.—The Canada Cement Company's Lakefield hydro-electric development is located about 9 miles from Peterborough. The drainage area of the watershed at Lakefield is approximately 2,700 square miles. The new development furnishes power to the Canada Cement Company's mill No. 7 at Lakefield and operates in parallel with their developments at other points, which have installed respectively 450 and 1,000 kva. Owing to the varying tailwater head, a movable blade turbine of 2,300 to 3,100 hp. was installed. The turbine is direct-connected to a Swedish General Electric 2,500-kva., 2,400-volt, 60-cycle, three-phase, 112.5-r.p.m. vertical type generator with direct-connected exciter. It is equipped with motor-driven flyballs and is provided with a hand pump for controlling the gates in case of failure of the pumping units.—*Electrical News (Canada)*, April 1, 1929.

*Irrigation Water Utilized by Automatic Hydro Plants.*—E. A. Crellin.—Mutual benefits accruing to all parties concerned where power and irrigation interests join forces in the full development of natural resources are emphasized again in the recent enlargement of the hydro-electric generating facilities in the plants of the South Yuba system of the Pacific Gas & Electric Company. In general, low-head or small-flow hydro-electric projects are not financially attractive in competition with the lower construction and operating costs of modern steam-electric generating stations. The storage and control of water for irrigation purposes, however, is a matter of increasingly vital importance to the advancement of agriculture and its related industries in the West. It is through the co-operative development of available water supply that the economic balance is swung to favor the small automatic and semi-automatic plant. When the two uses for a given supply of water thus are combined, each interest is enabled to attend strictly to its own business and to avoid branching out into a by-product side line. *Electrical West*, April 1, 1929.

## *Units, Measurements and Instruments*

*Portable Oil Testing Apparatus.*—H. Wommelsdorf.—While it is very desirable to test the dielectric strength of oil of transformers and oil switches in various more or less accessible localities, no readily portable equipment is yet in existence, because all the known types use a transformer, the weight and bulk of which well-nigh deny the term of "portability." A German concern has recently developed a real portable oil tester, packed complete in a suitcase, and weighing but 16 lb. It contains a small, hand-operated condenser machine with a revolving disk, similar to the Whimshurst machine, which is capable of producing a high-voltage direct current of up to 85,000 volts and 0.03 milliampere, sufficient to puncture an oil gap of $\frac{1}{10}$ in. between 1-in. electrodes. The small output of the machine prevents an arc and therefore does not carbonize the oil. The construction of the machine is such as to be very little affected by varying degrees of air humidity. — *Elektrotechnische Zeitschrift*, February 28, 1929.

*Remote Indicator.*—A. Imhof.—A description of an instrument which transmits electrically any amount of angular motion with perfect precision. The transmitter and receiver are identical and consist of a stationary single-phase alternating-current field, within which is located a movable coil. The ends of this coil are connected to the moving coil of the receiver, the stator of which is energized from the same supply as the transmitter stator. The principle is therefore the same as that of the well-known American "Selsyn" indicator, with the difference that the "Selsyn" system uses a three-phase stator, while the European instruments are of the single-phase type, and consequently require only a four-wire connection as against five wires for the American method.—*Elektrotechnik und Maschinenbau*, March 10, 1929.

*Investigating Lightning Surge Voltages.*—Everet S. Lee.—A most important factor in the design and operation of transmission systems is a knowledge of the characteristics of the surge voltages on the lines due to lightning. Until about five years ago the only device generally available for determining these was the sphere-spark gap, for which purpose it was quite limited in that it produced an indication which only said that the crest value of the voltage was at least the indicated value. This was helpful and allowed conclusions of value to be drawn from the results obtained therewith, but it was not totally sufficient. The difficulties attendant to line studies, therefore, caused investigators to turn to the laboratory, where extensive investigations were carried on by the manufacturer of transmission system equipment in which the operating engineer co-operated. Giant lightning generators were built, a model village was constructed and transmission lines and artificial bolts from the lightning generator were trained upon it. The characteristics of the lightning generator being known, the effect produced could be ascertained. Thus the principles of lightning protection were studied.—*Electrical News (Canada)*, April 15, 1929.

## *Generation, Control, Switching and Protection*

*Bearing Currents in Generators.*—R. Pohl.—The main cause of currents, established along the shaft through bearings and bedplate on generators, is the magnetic joints in the stator iron on machines made in two halves. Two alternating fluxes are thus established, one passing pole gaps and solid part of the stator, the other passing pole gaps and stator gaps. Having a larger resistance, the latter flux is much the weaker one. However, recent investigations indicated that such bearing currents may also appear in two polar turbo-generators with no magnetic joints in the stator. The magnitude of these currents becomes in some cases sufficiently dangerous to necessitate the electric insulation of one bearing from the bedplate. Systematic research with the aid of an oscillograph disclosed the fact that even slight eccentricity between rotor and stator may cause considerable bearing currents. A large number of tests were made on a two-pole, 3,000-r.p.m., 12,000-kva. generator, on which it was possible to displace the rotor. Under short-circuit condition the bearing current reaches several times the magnitude of its normal value. A detailed discussion of 21 oscillograms is given to explain cause and magnitude of resulting bearing current.—*Elektrotechnische Zeitschrift*, March 21, 1929.

*Parallel Operation of the Lourches and Valenciennes Power Stations.*—M. Haveaux.—A review of the considerations which led to the construction of an interconnecting line between Lourches and Valenciennes power stations, for the parallel operation of these two installations. It is further shown how this interconnecting line operates, while a description also is given of the conditions of service and of the economic results obtained. — *Bulletin Oerlikon*, March, 1929.

*Low-Voltage Oil Switches.* — H. Franken.—The present great demand for motor starters and automatic protective switches, suitable for circuits of 220 to 550 volts, brings the question whether dry, air-insulated or completely oil-immersed apparatus should be used. It seems that the only disadvantage of the latter type—that is, the inherently bothersome character of an oil filling—is greatly outweighed by the advantages. The necessarily somewhat delicate lever mechanism of small automatic motor switches is difficult to keep free from dust, magnetic blow coils and arc chimneys require much room and striking distances in air, particularly near the ionized zone of the arc, must be generous. All of these problems disappear or dwindle to a minimum for oil immersion. In addition, the mechanical damping effect of oil is beneficial in warding

off shocks, enables heavy overloads and makes the switch fireproof. Experience has indicated that about one quart of oil is sufficient for every 10 amp. capacity. For direct current oil immersion cannot be recommended, on account of the severe carbonization caused by a d.c. arc.—*Elektrotechnik und Maschinenbau,* March 10, 1929.

## *Illumination*

*Analysis of Street Lighting Installation Costs in Seattle.*—GLEN SMITH.—The city of Seattle recently placed in service one of the most extensive and in some respects the finest decorative street lighting system in the country. Practically the entire business district is covered by the new high-intensity lighting which serves altogether 10 miles of downtown streets. The outstanding features of the new system, aside from its extent, are the high and even illumination provided on the street, the beauty of the posts, which are bronze on the outside, and the provisions that have been made for increasing the intensity at some future date if desired. The installations comprise 1,361 standards providing illumination for 51,000 ft. of streets. The total cost was $806,640.87, or an average cost of $594.15 per post. This cost was levied against 89,786 ft. of assessed property, or an average cost of $9.01 per foot assessed. As a result Seattle now has 1,317.27 miles of lighted streets. The street lighting distribution system comprises 783.82 miles of overhead system and 45.62 miles of underground system.—*Electrical West,* April 1, 1929.

*New System Used in Lighting Leaside Station.* — The Toronto-Leaside transformer station, with its large outdoor switching equipment and the extensive area occupied, presented a new problem in floodlighting to the Hydro-Electric Power Commission of Ontario. The complete property of this new Toronto terminal for Gatineau power comprises an area of about 12½ acres, of which a considerable proportion will be occupied ultimately by outdoor switching equipment and structures. Such an extensive group of outdoor switching would have presented a difficult problem for adequate lighting for night operating and inspection, but with the introduction of 220-kv. structures, and their accompanying larger dimensions, the undertaking was more considerable. Various systems of floodlighting were investigated, but the usual forms were considered inadequate due to the harsh shadows created and the glaring light sources. Because of these inherent weaknesses a comparatively new method of lighting was proposed and finally adopted. Briefly, it consists of a prismatic glass street unit, modified in detail for use in an inverted position so as to project practically all of the light emitted from the lamp above the horizontal plane. These units are mounted on steel standards located in convenient positions to illuminate the structures.—*Electrical News (Canada),* April 15, 1929.

## *Heat Applications and Material Handling*

*Some Advantages of the Electric Furnace for Heat Treating.*—P. C. KELLY.—Probably no single branch of industrial electric heating has grown at a more rapid rate than heat treating with the electric furnace. The actual sales, expressed in connected kilowatts, of a number of the larger electric furnace manufacturers increased from 1920 to 1927 from 10,000 to 55,000 kw. per year, or five and one-half times. The increase from 1924 to 1927 was from 15,000 to 55,000 kw. per year, or three and one-half times. Any justifiable contribution to industrial progress in the way of a machine or plant equipment must accomplish one or more of the following results: Cost less to operate; have a lower first cost; require less labor to operate; require less maintenance; increase production; reduce the amount of rejects; produce a better product; result in better working conditions, and give a definite final cost for producing a definite quality product.—*Electrical West,* April 1, 1929.

## *Electrophysics, Electrochemistry and Batteries*

*Application of Ozone.*—M. P. OTTO—This paper is a condensed address by the author to the French Institute of Electrical Engineers. After a short explanation of the chemical constitution, electrical production and quantitative analysis of ozone, the article gives an elaborate description of the four major applications of ozone; that is, as an aid to synthetic chemistry, such as the production of vanilline and artificial perfumes; industrial bleaching processes; the accelerated aging process of wood, and purification of drinking water. While the first, second and fourth applications are well known and widely in use, the wood-treating method is almost unknown and deserves great attention. Green wood takes several years storage before it completely dries out and solidifies its resinous matter. Heating in large tanks hastens the dehydration, but fails to dry the resin. Heating with plenty of ozone present accomplishes both in a few days. The last chapter of the article describes up-to-date French equipment for the purification and sterilization of metropolitan drinking water supply systems by means of ozone.—*Bulletin de la Société Francaise des Electriciens,* Vol. IX, No. 90, 1929.

*How Power Is Supplied to Electrolytic Processes.*—J. V. ALFRIEND, JR.—In the electrolytic industry the continued growth requires an average yearly world purchase of approximately 200,000 kw. capacity in direct-current machinery. Most of this expansion has been utilized by a normal growth in the electrolytic production or refining of aluminum, copper, nickel, caustic soda and chlorine. With present-day refinements in electrolysis of these materials and developments of greatly improved methods for electrolytic production of lead, zinc, hydrogen and oxygen many old plants must be remodeled and a large number of new plants will be constructed. This indicates that the yearly increment of installed direct-current capacity will increase sharply in the future.—*Power,* April 9, 1929.

## *Traction*

*Electrodynamic Brake for Railway Cars.*—H. THOMA.—In switching yards and railway terminals, where freight cars are assembled to train sections, stationary brakes, arranged parallel to the rails, are commonly used to stop a rolling car. The braking power is usually regulated by more or less pressure, exerted by compressed air cylinders upon the brake bar. Considerable wear and the danger of car wheels climbing up on the brake bar are decided disadvantages of this method. To avoid these, a German concern, in cooperation with the federal railways, has developed an electric eddy current brake, in which two long steel bars are placed close to each rail. These bars are mounted on a number of magnetizing coils, through which a strong direct current is made to flow. The sides of the bars, facing the rail, have small square pole pieces, around which a punched copper winding is placed. When a car wheel passes these bars a very heavy, although gradual, dynamic braking effect takes place, which can be readily adjusted by varying the current in the magnetizing coils. There is neither wear nor a pinching effect upon the tire of the car wheel. Diagrams indicate the resulting braking power with various speeds.—*Elektrotechnische Zeitschrift,* March 21, 1929.

## *Miscellaneous*

*More Electrical Penetrations.*—WARWICK HOLMES.—Where road construction operations are contemplated within a city there seems to be no excuse whatsoever for ignoring the economic and convenient factors of electric power. Tardiness to adopt electric power for urban road construction is due to the difficulty faced by building contractors in obtaining a supply of electrical energy. Electricity is used to operate drums of cable, in building docks and harbors, excavating machinery, draglines and cranes.—*Electrician (England),* March 29, 1929.

*Portable Electrically Driven Woodworking Tools.*—The extended facilities for supplies of electric power available not only in modern factories and works but on those sites on which large buildings are being erected have resulted in the rapid development of plant for economically using that power in erection and other operations hitherto largely carried out manually. Examples of such means are seen in the series of portable electric wood-working tools. The essential feature of the tools is the use, in a variety of ways, of what has become known as the mortise chain.—*Engineering (England),* March 29, 1929.

# News of the Industry

## Edison Pioneers Sponsor Lighting Jubilee

*President Hoover Will Be Honorary Chairman of Their General Committee, and Men of Note Are Its Members—John W. Lieb is Chairman*

PRESIDENT HOOVER has accepted the honorary chairmanship of a general committee that the Edison Pioneers have set up to sponsor the international and national celebration of "Light's Golden Jubilee," to be held this year, beginning May 31, in honor of the semi-centennial of the invention by Edison of the incandescent electric light. This announcement was made on Tuesday by Paul D. Cravath at a luncheon given by him in New York to prominent newspaper publishers and editors. Mr. Cravath read a brief acceptance from Mr. Hoover, in which the President said: "I shall be delighted to act in any capacity that will mean a genuine tribute to Mr. Edison's services."

Mr Cravath is one of the members of the committee referred to, which will function under the chairmanship of John W. Lieb. Others who have accepted membership on this committee up to date are General Robert Lee Bullard, Newcomb Carlton, John W. Davis, Harvey Firestone, Henry Ford, James W. Gerard, Clarence H. Mackay, James H. McGraw, Andrew Mellon, John D. Rockefeller, Jr., and Charles M. Schwab.

The celebation, as before reported, will be marked by a series of light festivals beginning at Atlantic City during the convention of the National Electric Light Association. It will end in an international tribute to the inventor on October 21. On that day a testimonial dinner to be given to the inventor by Henry Ford, at Dearborn, Mich., will be attended by many of the most distinguished men of America. It will also be the occasion of the dedication at Dearborn of the completely restored laboratories and other buildings from Menlo Park, N. J., which will permanently preserve for the people a record of the life and inventions of Edison. There will be an extensive radio program and other festivities.

## New 150,000-Kw. Plant for Ashtabula, Ohio

Advices from the eastern division headquarters of the Cleveland Electric Illuminating Company at Ashtabula, Ohio, say that this company will break ground within a week for another generating plant, which will be built on a site on the shore of Lake Erie a short distance east of Ashtabula. This plant, which will be similar in its general plan to the Avon station, will have an ultimate capacity of 400,000 kw. The initial installation will be 150,000 kw. and will cost approximately $11,000,000.

Power will be generated by 50,000 kw. turbo-generators, three of which will be installed immediately. Each of these turbo-generators will be supplied with steam from a pair of pulverized-coal boilers of 3,256 rated horsepower each. Each pair of boilers will be surmounted by one stack. When the plant is completed, there will be eight such stacks, each 300 ft. above lake level. The new plant will draw its water supply from Lake Erie, a basin being formed by extending two breakwater walls 1,500 ft. into the lake. The intake will be 400 ft. wide at the mouth, and when the initial installation is in full operation water will be pumped from the lake at the rate of 300,000 gal. a minute.

Current will be generated at 13,800 volts, transformed to 132,000 volts and transmitted by the company's new high-tension lines to its Sanborn substation in Saybrook Township, where these lines will tie in with the system connecting with the Lake Shore station at East Seventieth Street and Lake Erie in Cleveland and with Avon station in Avon Village, on the lake 20 miles west of Cleveland. The building which will house the initial installation will be 250 ft. x 325 ft., with height of 100 ft.

When the initial installation of the Ashtabula station goes into operation, the Cleveland Electric Illuminating Company system will have a total generating capacity of about 575,000 kw. The company expects to have the first generating unit in operation in August of next year, the second in September and the third in October.

## International Paper Company Investments

### Federal Trade Commission Hears of Its Interest in Fourteen Daily Newspapers—Newsprint, Not Power, Business Aided —P. G. & E. Denies Interstate Business

THAT the holding of interest in fourteen daily newspapers is a legitimate adjunct to the business of the International Paper & Power Company, twice over the world's largest newsprint producer, was maintained by Archibald R. Graustein, president of the company, voluntary witness in the public utility investigation hearing held Tuesday, April 30, before the Federal Trade Commission. No attempt was made to dictate the policy of these publications, Mr. Graustein asserted, the only aim being to establish the sale of paper in a competitive market.

On becoming head of the paper company, Mr. Graustein was faced with a serious problem, he testified. Newsprint was selling at a bare profit under the prevailing price of $75 per ton and still lower prices were predicted. The logical solution was to diversify, realizing on power properties through the sale of electricity and establishing paper sales by gaining interest in newspapers. To this end the International interests attained more than 82 per cent control of the New England Power Association, the largest power group in New England in kilowatt production and second largest in gross receipts, dealing largely in the less profitable wholesaling of electricity.

Although the power business of the International Paper & Power Company has grown to equal or exceed that done in paper, Mr. Graustein pointed out the necessity of maintaining production volume in newsprint to offset the heavy fixed charges. This was given as the main reason why the company sought to finance newspapers on condition of an exclusive newsprint contract in return.

The principal questioning concerned the purchase of 50 per cent of the stock of the Boston Publishing Company, which controls the Boston *Herald* and Boston *Traveler*. Frank D. Comerford, vice-president of the International Paper & Power Comapny, who handles the power holdings, opposed this move because of its possible adverse effect on public opinion. Inasmuch as other paper companies had been using the same method of maintaining contracts and had taken some of the International's business by this means, Mr. Graustein said he felt compelled to proceed, with the assurance that his position would be vindicated when the facts were known. The newsprint business of the two Boston papers was vitally needed at the time of their purchase, it was declared, because the International Paper Company showed a deficit of $4,706,000 last year after payment of dividends.

Any attempt to change or control the policies of newspapers was vigorously denied. Mr. Graustein made the point that he would not be so foolish as to destroy confidence in the publications or in his company's power interests by such tactics. The newspaper holdings are carried through a complex system of subsidiary companies and holding trusts, it was pointed out, to the end that the only obligation of the papers is to buy their newsprint from the International Paper Company. In return,

the company assures them a steady supply the failure of which would be a catastrophe in case of general shortage.

Other newspaper holdings are as follows: Chicago *Daily News*, $250,000 in preferred stock and 3,000 shares of common stock; Chicago *Journal*, $1,000,000 debentures, 600,000 shares preferred stock and 10,000 common; *Knickerbocker Press*, Albany, N. Y. and Albany *Evening News*, $450,000 preferred and 3,000 shares common; Brooklyn *Eagle*, $1,954,000 notes and 400 shares common; Hall & Lavarre, $855,000 notes secured by stock of Augusta (Ga.) *Chronicle*, Columbia (S. C.) *Record*, Spartanburg (S. C.) *Herald* and Spartanburg *Journal*. A contingent interest is held in the Ithaca (N. Y.) *Journal-News* through a note the Greensboro (N.C.) *Record* figured for $300,000. The Tampa *Tribune* and in the Chicago *Journal* negotiations.

Unsuccessful attempts were made toward stock ownership in the Cleveland *Plain Dealer* and in *El Progresso*, a New York City Italian newspaper, Mr. Graustein testified.

Corroborative testimony was also heard from R. L. O'Brien, former president of the Boston Publishing Company; James Garfield, secretary of the same, and J. R. Macomber, director of the International Paper & Power Company. Robert E. Healy, chief counsel for the Trade Commission, stated that Mr. Graustein's testimony had been so frank and complete that further questioning of the witness will be unnecessary at this time.

### California Inquiry Strikes Snag

On Thursday the utilities investigation was to proceed with the calling of A. E. Wishon, former secretary of the California Light & Power Association, and James Pollard, present secretary, both of San Francisco. The commission's investigation of California utilities has, however, struck a snag in the request of one of the principal witnesses to be excused from testifying. A. F. Hockenbeamer, president of the Pacific Gas & Electric Company, claims that his company is not engaged in interstate sale of power and therefore is not within the commission's jurisdiction. His appearance will depend on further action in Washington. It is pointed out that Mr. Hockenbeamer was a member of the public policy committee, N.E.L.A., and might be subject to call concerning propaganda activities.

In the hearing of April 25 an apparently unsuccessful attempt was made to show that the Pacific Gas & Electric Company is carrying on interstate commerce. W. T. Crawford of Stone & Webster's Boston office, who is secretary of the Sierra Pacific Electric Company, stated that the Pacific Gas & Electric Company is furnishing the Sierra with standby service which is taken off at Summit, Calif., about 20 miles from the Nevada line. The Sierra company markets a large part of this energy in Nevada, but the Pacific Gas & Electric lines do not cross the boundary, it was declared. After the hearing, Robert E. Healy, chief counsel for the commission, said orally that he had gathered sufficient evidence concerning this point probably to obviate the necessity of further inquiry.

## Graustein Also Testifies in Massachusetts

*President of International Paper Company Tells State Legislative Committee that No Propaganda Is Involved in Control of Boston Newspapers*

FULL explanation of the power policies of the International Paper Company was made on Monday of this week before the joint committee on rules of the Massachusetts Legislature by Archibald R. Graustein, president of the company. The legislative committee is considering a resolution for an investigation of the whole power industry in view of recent holding-company developments in the state. Mr. Graustein was on the stand for two hours. He set forth the advantages of hydro-electric connections between the plants of the paper company and the power industry in New England, pointed out the value of centralized development in electrical production, transmission and distribution, and commented frankly upon the policies underlying the expansion of the New England Power Association, with special reference to the Worcester Electric Light Company rate case and the decision to withdraw court proceedings soon after taking over the property and to accept the finding of the Massachusetts Department of Public Utilities.

The International Paper & Power Company controls the paper company, Mr. Graustein freely admitted, and in another line, so to speak, the International Hydro-Electric System. The last-named controls the New England Power Association and the Canadian hydro-electric properties of the paper group. "Neither the paper company nor the power association has any 'say' in the management of the Boston *Herald*," said Mr. Graustein. "We did not want anything to do with the management of the *Herald* and recognized that about the best way to ruin a paper is to make it the organ of some special interest. The power side of our business has nothing to do with this investment."

Minority interests have been acquired by the power association in the North Boston Lighting Properties and in the Massachusetts Utilities Associates, Mr. Graustein said in reply to a question. A large interest has been acquired in the Fall River Electric Light Company, which will be added to the system soon. Mr. Graustein denied any interest in the Holyoke Water Power Company or the Western Massachusetts Companies, saying that the policy of the association is to interconnect and control properties in its territory. Of the total $600,000,000 capitalization of the International Paper group, about half is in the power field and half in newsprint.

## Comerford Speaks Freely

*President New England Power Association Admits that Worcester Company Was Bought at High Price—Tells Reasons and Motives.*

SIDELIGHTS upon the policies of the New England Power Association were furnished this week at a legislative hearing in Boston by President Frank D. Comerford, who freely discussed the purposes of the organization in developing its field through the purchase of local central-station companies. Mr. Comerford appeared before the joint committee on rules, following A. R. Graustein, president of the International Paper & Power Company. Most of Mr. Comerford's testimony was in response to questions from the committee in regard to power developments in Massachusetts. Like Mr. Graustein, Mr. Comerford disclaimed any opposition to an investigation, but said he saw no need of one as a safeguard to Massachusetts.

President Comerford, queried as to the high cost of purchasing the Worcester Electric Light Company, for which $226 per share at $25 par was accepted, said: "Our company has owned some stock in this central station for several years. It is located in the heart of our system, and we already do a large power business among Worcester industries under the limitation of not going below 300 hp. fixed by the Massachusetts commission years ago. We made a much lower offer for the Worcester company and it was favorably regarded until at the last moment representatives of a competitor appeared on the scene and offered $225 per share and a salary increase to a prominent executive in case the deal went through. We were given two hours to meet this offer and did so by making it $226. This price was too much, but we felt that we should pay it rather than have the property fall into hands which might not co-operate with us. We already owned about 30 per cent of the stock. Would you not prefer that we should have done this to having the company pass outside of New England hands?" Mr. Comerford added that about 35 per cent of the Worcester stockholders elected to accept about $7,000,000 cash, 35 per cent taking the association's 6 per cent preferred stock in exchange.

"As soon as we acquire the Worcester company," said Mr. Comerford, "we shall ask the directors to approve withdrawing the rate case from the federal court. It is our policy to co-operate with the regulating commissions in the states where our subsidiaries operate, and we expect to put the 5-cent maximum rate into effect in Worcester in accordance with the order of the Massachusetts board. The electric power business is of necessity pretty much of a monopoly, but we think there is nothing to fear under state regulation. If the commissions lack adequate regulative powers, let them have them. We do not oppose an investigation of the power industry in Massachusetts, but

for twelve months in the past fifteen we have had from two to ten representatives of the Federal Trade Commission going through our books and papers, and the work has cost us at least $20,000, besides clerical labor, and has interfered not a little with the regular conduct of our business. There is such a thing as investigating an industry to death."

Regarding a statement that the municipal plant at Hudson, Mass., could produce below the price offered it by the New England Power Association, Mr. Comerford stated that the latter had offered to sell electricity to Hudson at 10 per cent less than the cost of producing it in a small local plant, such cost to be determined by an independent firm of engineers. He pointed out that the low power rates of the association had been a prime factor in keeping the American Steel & Wire Company in Worcester and said that these compare favorably with any in the East outside of special locations like Niagara Falls.

Mr. Comerford said further that the Fall River Electric Light Company will soon be taken over by the association, which has about a 53 or 54 per cent interest, the Eastern Utilities Associates having the remainder. This arrangement has the advantage of making it possible to co-ordinate the work of the company with that of the Narragansett Electric Company, 12 miles away at Providence, R. I., and to utilize the highly efficient Montaup station near Fall River for expansion in steam generating facilities. "The future of Massachusetts will be bettered by the inevitable acquisition of local central-station properties by the centralized group," Mr. Comerford said. "Economics is forcing such integration." He added that no further negotiations for properties are in progress at the present time.

## Purchases and Mergers

Purchase of the Keyser (W. Va.) Light & Power Company by the Potomac Edison Company is announced. The plant will be put in operation as a part of the Potomac-Edison system.

No opposition to the proposal of the Edison Electric Illuminating Company of Boston to purchase the electric plant of the American Woolen Company at Maynard, Mass., was voiced at a hearing before the Massachusetts Department of Public Utilities. The Edison company purposes to extend its lines from Saxonville through Sudbury to Maynard and Acton at a cost of $105,000. Expenditures in connection with the purchase and extension will total $486,000.

The Missouri Public Service Commission has authorized the Missouri Public Service Company to purchase all of the capital stock of the Windsor Light & Power Company for $80,000, but the new owner will be permitted to capitalize the plant at only $50,000 for rate-base purposes.

The Inland Electric Company of Kansas City, Mo., has offered to pay the city of Shelbyville (Ill.) $140,000 for its electric distribution system and franchise and also to put in a generating plant costing $200,000 and to furnish the city with free light for its streets, hospital, library and park.

The Indiana Service Corporation has asked authority to acquire the property of the Pleasant Mills (Ind.) Light & Power Company at $7,500.

The Nebraska Electric Power Company has bought the distribution system of the village of Madrid.

The Kentucky-Tennessee Power Company, Bowling Green, Ky., has purchased small operating utility companies at Rising Sun and Loogootee, Ind., in the south central part of that state.

The voters of Upton, Wyo., will be asked at a special election on May 21 to approve the sale of its municipal electric light plant to the Mountain States Power Company for $40,000.

The Chester (Nova Scotia) Light & Power Company, organized in 1924, has sold out to the Avon River Power Company.

## Federal Water-Power Act Under Fire

*Merrill Comes to Its Rescue at Washington Convention of United States Chamber of Commerce—Leighton on Steam Versus Hydro*

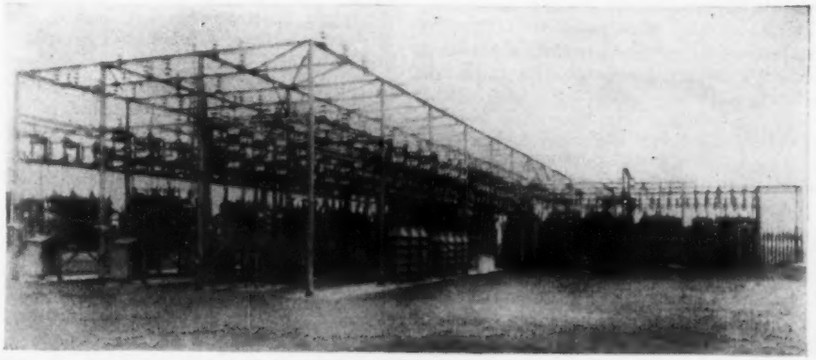
ELIMINATION from the federal power act of Section 14, relating to governmental recapture of power sites, was proposed by General Charles Keller of the Northern States Power Company during the water power and raw materials conference which was, from the point of view of the power industry, one of the most interesting events at the seventeenth annual convention of the United States Chamber of Commerce in Washington this week. General Keller declared that this section provides in effect for government operation of hydro-electric plants. He also criticised Sections 19 and 20 of the act, saying that these sections should be repealed or modified because they permit the federal government to regulate the rates, service and issuance of securities of power companies a small part of whose operations may come under terms of the act.

A denial that unreasonable powers have been given to the government in the provision for recapture of power sites was made by O. C. Merrill, executive secretary of the Federal Power Commission. This provision merely enables the federal government to acquire the sites at the expiration of the periods of license, he said. Regarding the commission's supervisory powers over the issuance of securities, he stated that the only condition imposed on the power companies coming under the terms of the act is that they give notice of their financing plans.

A resolution asking the chamber to go on record as opposed to the proposal for leasing Muscle Shoals under such terms that a particular company will receive a subsidy was presented by Charles J. Brand, executive secretary of the National Fertilizer Association. It was agreed that the resolution should be acted on later by the main body of the convention.

Hydro-electric exploitation has become an obsolescent factor in power development as far as the government ownership advocates are concerned, M. O. Leighton, consulting engineer and former member of the Water Resources Branch of the Geological Survey, declared. Mr. Leighton explained that the small group which is agitating to get the government into the power business has no longer a weapon in the control of power sites, since the utilization of hydro-electric power has reached its zenith in most sections. He remarked also that as regards many power sites on streams that seemed promising twenty years ago efficient development has become impracticable because of the better methods that have come about in steam-plant operation. He thought that the public was beginning to get a rational view of the situation.

## Telephotography an Aid to Expedition in Engineering



QUICK action in central-station engineering matters is sometimes desirable. H. W. Young, president Delta-Star Electric Company, Chicago, sent to the ELECTRICAL WORLD over the Western Union wires on Tuesday last this telephotograph of the new 33,000/66,000-volt substation of the Public Service Company of Northern Illinois at Bellewood, near Chicago. This substation is connected with the system of the Commonwealth Edison Company. It is the first picture of an outdoor substation ever sent by wire and shows what the industry can accomplish by this process when speed is desired.

# In the States' Legislative Mills

## Bills of Concern to Power Companies Die in Closing Sessions of Minnesota and Nebraska Legislatures—Wisconsin Utility Bills Increase in Number

LEGISLATORS in Minnesota and Nebraska have joined their fellows in the majority of the commonwealths who are resting from their lawmaking labors. As in so many other states, most of the bills that would have affected light and power companies or their regulation failed of passage.

MINNESOTA.—All bills which might have had an adverse effect on power companies operating in Minnesota either were killed by vote or died in committee at the session of the Legislature which closed last week. That there will be no state regulation of electric utilities for two years at least was assured when three measures designed for that purpose were lost. The bill introduced by Representative Rodenberg, St. Paul, proposing that, "following the enactment of immediately proposed legislation, an interim committee be appointed to survey the entire situation" and make recommendations at the next session, two years hence, also was lost. Another measure which would have involved a constitutional amendment "to permit the state to acquire water-power sites and develop hydro-electric power for state usage and sale to the public," with an initial bond issue of $50,000,000, was killed.

A bill giving the state conservation commission authority to permit and prevent change of water levels of state waters passed, though the Governor had not signed it at the time of writing. The Governor signed bills authorizing cities of the third class to supply electricity to residents within one mile from the city limits and authorizing certain cities to provide salaries for members of water, power and light commissions. A joint resolution memorialized Congress in favor of adjusting settlers' claims resulting from increased levels of the Lake of the Woods brought about by power dams, and another joint resolution favored the passage at Washington of the Shipstead-Newton bill affecting water power on the Canadian boundary.

NEBRASKA.—During the last hours of the Legislature the House killed, by a blanket motion affecting all unconsidered bills on its calendar, all of the remaining Senate bills affecting the power and electric interests and which were part of the legislative program of the League of Municipalities. The only bill of importance which passed both Houses and was signed by the Governor is one which was amended satisfactorily to the power companies. It permits municipal plants to build 15 miles out into a rural district, but only where contracts have been secured that show a gross profit of 15 per cent. The companies urged 25 per cent. The House indefinitely postponed the league's favorite bill, passed in an emasculated form by the Senate, which permitted building out by municipal plants as far as 25 miles, the members disapproving of the scheme of pledging future earnings and barring town taxpayers from a vote on the proposition.

Under the provisions of a bill passed by both houses power companies using more than 75 per cent of the water flowing in a ditch or channel which crosses public highways, which may or may not also be used for irrigation or drainage purposes, are required to build and maintain bridges at all such crossings. The companies were also interested in a rewriting of the workmen's compensation law submitted by a specially named commission.

Governor Weaver has signed a bill re-enacting the law passed in 1927 permitting urban and rural communities to form hydro-electric distribution districts, amended so as to meet legal objections raised in a suit now in the courts to test its constitutionality in connection with an organization in Scottsbluff County.

WISCONSIN.—The utility measures on which hearings were held last week and which are being supported by the full force of the 208 cities and villages in the League of Wisconsin Municipalities are: (1) the Reis joint resolution to amend the constitution in order that Wisconsin may be able to take advantage of the water-power recapture law of 1915; (2) the Thayer bill to prevent discrimination in electric service rates in municipalities and their surrounding rural areas; (3) the Loomis bill to permit municipalities to establish and operate electrical utilities in competition with existing privately owned utilities performing the same service; (4) the Reis bill to allow municipalities and intervening rural areas to establish districts (similar to joint school districts) for the purpose of establishing electrical utilities and distributing electricity; (5) the Carow bill to permit municipalities to borrow money on public utility property in order to buy or establish such property, without having such loan become an obligation against the municipality itself.

Adolph Kanneberg, member of the Railroad Commission, expressed his approval of all these bills except the Loomis bill. Mr. Loomis has another measure which forbids the Railroad Commission in placing a valuation on the plant to give any consideration to contracts for the wholesale delivery of power or to severance value obtained through the plant being a member of a large interdependent system.

A bill directing the commission to develop and put into force a uniform basis for rural electric rates and services has been presented by Senator C. Schumann.

Assemblyman Budlong has introduced a new measure to prevent construction of a dam on the Wolf River where it flows through an Indian reservation.

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# Load Building Stressed by Southwestern Division

*Hot Springs (Ark.) Convention Also Emphasizes Importance of Rural Electrification and Public Relations—Merchandising Practices Discussed*

RURAL electrification was declared to be the most important factor facing the electrical industry in the Southwest by J. G. Holtzclaw, president of the Southwestern Division, N.E.L.A., in his address before the division's annual convention in Hot Springs, Ark., April 30 to May 3. This convention was held jointly with that of the Arkansas Utilities Association. Six hundred members attended.

Mr. Holtzclaw said the farmer does not want to be subsidized, nor is he an object of charity, but he does want an even break on electric service, which means so much to his comfort and prosperity. Mr. Holtzclaw also discussed the use of long-time payments in selling merchandise and stated that although the utilities desired to have all the sales outlets possible, the chief goal was to increase domestic use.

In an able address President P. S. Arkwright of the N.E.L.A. stressed the duty of utilities to bring to the public the advantages of electric service. He pointed to the fact that there is no middleman in the utility business and that the economic benefits and the conforts inherent in electric service can get to the public only through selling and advertising by the utilities. This is one thing that government ownership advocates neglect, Mr. Arkwright said, and the present electrification of this country has come about only because electric service has been sold to the users, often in competition with other services.

Other notable speakers at the convention were W. E. Bann, president of the Arkansas Utilities Association, who dwelt on the rapid growth of the Southwest; Charles W. Appleton, vice-president General Electric Company; W. J. Hagenah, John V. L. Hogan, E. H. Sniffen, H. C. Couch and H. B. Flowers.

The several sections held meetings and discussed reports and addresses dealing with public relations, commercial affairs, engineering developments and accounting activities. A notable report by the competitive power committee of the Commercial Section covered detail power and load requirements for the major industrial plants of the Southwest.

Features of the Engineering Section meeting were the reports of the committees and the discussion of the address on system planning made by L. W. W. Morrow, editor ELECTRICAL WORLD. There was agreement that utility advertising in newspapers was essential.

## Middle West Men Meet at Omaha

*Well-Balanced Program Includes N.E.L.A. Officers and Other Well-Known Speakers—One of the Three Days Given to Committee Meetings*

WITH a proportioned program that recognized the interests and activities of all sections of the utility business, the seventh annual convention of the Middle West Division of the National Electric Light Association met at Omaha on April 24, 25 and 26. One day was given over to the meetings of section committees, all of which were well attended and aroused much interest. From these meetings came reports of important developments and projects affecting the Middle West Division, among which were the power survey embarked upon by the Engineering Section and news from the legislative battle front of Iowa, Missouri, Kansas and Nebraska. This news indicated that, in spite of the apparently radical political tendencies of these states, legislation promoting government ownership and operation of electric utilities is not making much progress—contrary to the general impression created and fostered by the headlines in certain newspapers.

"The association has not the power of censorship or criticism," said P. S. Arkwright, national president, in his address to the convention, in repudiation of the charge that the N.E.L.A. is itself the "power trust."

J. F. Owens, chairman of the Public Relations National Section, made a logical and forceful argument for continuing and extending the consideration of the human equation in all activities of the business. He stressed the necessity for careful selection of employees.

His long experience in the field of research made C. E. Skinner a well-qualified speaker on the value of research in the electrical industry. Mr. Skinner traced the progress of research from its beginnings in the devoted efforts of single individuals to the organized probing into the unknown that is carried on in the great laboratories of the present day. Too much satisfaction with American methods and practices was not evident in the address by A. D. Bailey, who spoke on electrification in Europe. Although American electrification is much greater than European in terms of magnitude and wide application, it would be a mistake not to recognize the importance of present-day European contributions and development in the electrical art, Mr. Bailey said.

N. H. Boynton outlined the plans which have so far been made for the observance of "Light's Golden Jubilee" in commemoration of the fiftieth anniversary of the invention of the incandescent lamp. Another prospective activity was treated by Paul Zimmerman, who spoke of the plans of the National Food Preservation Council, which will seek to inculcate a "national refrigeration consciousness" by concerted activity. On account of illness, Sam A. Baker, ex-Governor of Missouri, who was on the program, was unable to attend. In his address, which was read into the record, he stated his opinion that there should be a course of study in the public schools on public utilities and their service and relation to the public.

The extremes in precipitation and the wide seasonal variation in the flow of streams make it difficult to estimate the hydro-electric potentialities of the Middle West, said C. W. Place, in his address on that subject. He thought that there is a possibility for utilization of this power by co-ordination of its seasonal availability with established systems. However, the actual amount of such power is extremely small in comparison with the demands of the territory and its development remains far in the future. Kenneth McIntyre presented a résumé of the survey recently completed under the direction of the National Electric Sales Conference. The results are not such as to inspire any self-congratulation, indicating as they do a very small domestic utilization of electric service.

These new officers were elected: President, A. E. Bettis, Kansas City, Mo.; vice-presidents, A. R. MacKinnon of Omaha, C. A. Leland, Jr., of Des Moines, and W. W. Austin of Cottonwood Falls, Kansas. New officers of the Iowa Section, Middle West Division, were also elected, as follows: President, C. S. Macy, Des Moines; first vice-president, G. A. Neal, Sioux City; second vice-president, H. C. Orton, Dubuque; secretary-treasurer, H. E. Weeks, Davenport.

## M. S. Sloan Testifies in Rate Case of New York Edison

Although the New York Edison Company is anxious to supply alternating current to all sections of Manhattan, it has been hampered by the fact that owners of buildings in certain districts have invested $100,000,000 in direct-current equipment, according to Matthew S. Sloan, president of the company. Mr. Sloan was on the witness stand on Tuesday of this week during a hearing before Public Service Commissioner William R. Pooley in the city's five-year fight to force reduction in retail energy costs.

Owners in the districts now served by direct current, Mr. Sloan said, must be "educated" to the advantages of alternating current. In time, he predicted, Manhattan Island will be served entirely by the latter, since it is more economical from the point of view both of the public utility and the consumer. Mr. Sloan said also that, notwithstanding the economies made possible by the consolidation of nearly all the Greater New York light and power companies, he thought no further reduction in rates could be expected this year, since the return to the company was far less than 8 per cent on its valuation. The saving in three months from abolition of the surcharge for coal had amounted to $529,265, he testified.

The hearing was adjourned until May 15.

## Worcester Electric Light Accepts 5-Cent Rate

By vote of a new board of directors elected on Wednesday of this week, just after the Worcester Electric Light Company formally became part of the New England Power Association, that company has discontinued its rate contest in the federal courts and has accepted the Massachusetts commission's rate of 5 cents, maximum, per kilowatt-hour. About forty thousand customers will receive rebates aggregating $700,000.

Samuel C. Moore was elected president, W. C. Bell vice-president in charge of operation, Leon E. Seekins general manager and C. S. Herrmann treasurer. Fred H. Smith was re-elected vice-president and assistant general manager. Frank D. Comerford will be chairman of the board. Former President Robert W. Rollins will take a position at Boston with the New England Power Association.

## Power Commission Suspends Control Over Securities

Following complaints from state public service commissions, the Federal Power Commission has postponed indefinitely the effective date of its Order 28. Apparently it was felt that this order would slow up still further the work of the commission by adding new duties. Order 28 provides that all licensees that are public utility corporations and desire to issue securities which affect any project and the issue of which is not subject to regulation by state authority must give formal notice to the commission and must not proceed with the issue of the securities for a period of 30 days, unless notified that the commission does not propose to exercise its jurisdiction over the proposed issue. If the commission notifies the licensee of its intention to assume jurisdiction, the issue must await approval of the commission.

The suspension of Order 28 took place at the first formal session of the new commission. James W. Good, the Secretary of War and new chairman, issued instructions that important matters to be acted upon should be presented in the form of a draft previously considered by the principal members of the commission's staff. In the event of differences of opinion the objections are to be set forth in detail.

## Snake River Filings in Idaho Are Renewed

Three filings on the Snake River in the vicinity of Twin Falls, Idaho, have been renewed by the Idaho Power Company, while a fourth was allowed its subsidiary, the Salmon River Light & Power Company, on the Salmon River.

The renewals were allowed under an old law. A new law, giving the Commissioner of Reclamation certain discretionary power in granting the permits, does not become effective until May 6.

One of the filings is on the Twin Falls, a double cataract near the city of Twin Falls. The filing calls for diversion of 1,500 sec.-ft. and provides for construction of two dams, each extending from one shore to the huge dividing rock in the middle of the fall. One dam would be 10 ft. high and 650 ft. long, the other 20 ft. high and 80 ft. long. The plant would develop 16,000 hp., and the dam is estimated to cost $40,000.

The second filing is on the upper Salmon Falls, in the western end of Twin Falls County, calling for 6,500 sec.-ft. to generate 48,000 hp. The fall would be 83 ft., with an 8-ft. dam, 1,600 ft. long, to be put up at a cost of $100,000.

The third filing depends upon the company's contract with the federal government. It is at American Falls and calls for 6,000 sec.-ft. of water, generating 30,000 hp., the dam to cost $90,000.

The Salmon River permit calls for 1,200 sec-ft. of water, to be diverted at a point 12 miles above Salmon. The site would generate 3,600 hp. from a 33-ft. dam to cost $60,000.

## Plans for the Priest Rapids Development Revived

Filings at Olympia, Wash., show that Henry J. Pierce of New York has revived his plans for the development of a power and irrigation project involving the damming of the Columbia River at Priest Rapids, Wash., where a future plant would have an ultimate rating of 450,000 hp. The cost of the enterprise is estimated at $41,242,000.

First rights were asked of the state in 1920 for a project of slightly less magnitude, but this option, as well as a federal permit covering the venture, was permitted to expire. The new filing, asking 50,000 sec.-ft. of the flow of the largest river in the West, would also require the creation of a reservoir of 140,000 acre-feet. The dam would be 90 ft. high and 12,000 ft. long. It would be constructed of concrete for a distance of 5,400 ft. with earth fill for the remainder of the distance.

This reservoir would submerge a total of 5,715 acres of land and would store water to be used in a two-unit power development. The first unit would have an output of 200,000 hp. and would be undertaken as soon as possible after the issuance of the state and federal grants necessary. The second would not be undertaken for at least three years. The reservoir, according to the plans submitted to R. K. Tiffany, state hydraulics supervisor, would be in both Yakima and Grant Counties.

This undertaking, which besides its power features, would serve the irrigation needs of a district within a radius of 50 miles or more, would be carried out under the name of the Washington Irrigation & Development Company of Seattle.

# Briefer News

PROGRESS AT JACKSONVILLE, TEX.—Improvements to the amount of $350,000 are being made to the power plant of the Gulf Public Service Company at Jacksonville, Tex. They consist of the installation of a new steam turbine and boiler, new brick boiler and engine room and a new brick building for the entire plant.

BROOKLYN (N. Y.) DEVELOPMENT HAILS SAVING BECAUSE OF ABSORPTION OF LOCAL POWER COMPANY.—The announcement made last week that the Brooklyn (N. Y.) Edison Company had taken over the local lighting corporation of Gerrittsen Beach, a territory within the borough of Brooklyn, was hailed by the residents as a saving not only in the matter of rates, which will be reduced from 11 to 7 cents per kilowatt-hour, but in the matter of an annual meter rental of $5, which the Edison company announced would be abolished.

BRITISH COMPANY TO BUILD PLANT IN CAPE BRETON.—Canadian dispatches say that the British Empire Steel Corporation has completed plans for the erection at Glace Bay, Nova Scotia, of a power plant costing approximately $2,000,000 and equipped to supply power to the entire industrial district of Cape Breton, including the corporation's fifteen collieries and many surface plants. The project has been under consideration for two years or more. It is reported that the site, not yet announced, will be near No. 24 colliery, on the shore of Big Glace Bay Lake.

TWO ARKANSAS TOWNS BELIEVE IN RUNNING MUNICIPAL PLANTS AT A PROFIT FOR USE IN OTHER ENTERPRISES.—Hope, Ark., a place of about 5,000 population, has built a city hall at a cost of $67,000 without a bond issue, the city's power plant, which already pays a large part of the expenses of the city government, undertaking to retire the warrants issued at the rate of $8,500 a year. In Conway, Ark., a city of about the same size, a bond issue of $200,000 for educational purposes has been determined upon, to be retired by profits derived from the municipal electric plant.

INDIANA COMMISSION STILL SEEKING FUNDS FOR MERGER INQUIRY.—Formal request of Governor Harry G. Leslie of Indiana that a meeting of the state budget committee be called to straighten out the matter of emergency funds for the investigation of the seventy-million-dollar merger of Insull electric, gas and interurban properties has been made by the Indiana Public Service Commission. State budget regulations seem to preclude the possibility that any part of an emergency appropriation made by the last Legislature for merger investigation can be used for the employment of special engineers and accountants, and the commission suggests that it be permitted to borrow $20,000 from its "personal service" appropriation for the next fiscal year.

SHAWINIGAN COMPANY'S CONSTRUCTION PROGRAM.—The engineering department of the Shawinigan Water & Power Company is erecting a 60-mile power transmission line from Quebec City to Thetford Mines. Increased line facilities also are being provided for subsidiary companies. The company's engineers are making progress with their survey of the upper St. Maurice Valley power development site, although locations for the new plants have not yet been decided on. No construction work is likely to be started on this development before the first of next year.

WHITE MUD FALLS SITE IN MANITOBA GOES TO BRITISH SYNDICATE.—White Mud Falls, the 600,000-hp. site on the Nelson River, has been assigned to the British Dominion Power Company by the Manitoba government, Premier Bracken having presented a resolution to that effect in the provincial Legislature. The resolution reserves a large block of power for the Manitoba Hydro Commission at cost. Work must commence this summer. It is estimated that $20,000,000 will eventually be invested in the site. All the Hudson Bay mining district will be served, on terms approved by the Hydro Commission.

EXPERIMENTING ON MODEL FOR MORRIS DAM.—Prof. Ernest W. Schroder of Cornell University, a specialist in hydraulic engineering, has been in Rochester, N. Y., to inspect plans for the construction of the Mount Morris dam, according to Edgar R. Crofts, chief engineer of the Rochester Gas & Electric Corporation. The company plans to construct a wooden model of the dam and test it under the direction of Professor Schroder, who will decide whether the experiments can be carried out on the Middle Falls in the river or whether the model shall be taken to the Cornell hydraulic experimental station at Ithaca.

INTERSTATE LINE AT 66 KV. FROM TULSA, OKLA., TO FOREST PARK, ARK., WILL BE 86 MILES IN LENGTH.—Power resources will be added to the territory around Tulsa, Okla., as well as the district between Tulsa and western Arkansas, by an electric transmission line between the city named and Forest Park, Ark., to be completed some time in June. This line is being constructed by the Public Service Company of Oklahoma and will connect the ten generating plants of the company, with more than 75,000 kw. capacity, to the system of the Southwestern Gas & Electric Company of Arkansas. The new transmission line will be 86 miles long, will pass through the foothills of the Ozarks and will be of the very best engineering construction. Some of the spans between poles are as long as one-half mile. This line

is of 66,000-volt, H-frame construction and will make electricity available to several towns not now connected to the system of the Public Service Company of Oklahoma.

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CALIFORNIA - OREGON - MOUNTAIN STATES LINE INVOLVES $1,000,000.—The California-Oregon Power Company's new 60-mile, 110,000-volt transmission line from Dixonville, near Roseburg, Ore., to connect with the Coos Bay district of the Mountain States Power Company, will, according to A. L. Martin, Mountain States manager, cost $500,000. Reinsulation and installation to allow the increase in voltage on the present line at Dixonville will bring the total investment up to $1,000,000. Work is under way on a new boiler at the Marshfield power plant of the Mountain States company, at a cost of $133,000, to increase the capacity to 9,000 kw.

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SALT LAKE ELECTRICAL MEN ENJOY "GET TOGETHER."—The annual "get-together" meeting of the members of the electrical industry in Salt Lake City and adjacent territory was held April 9 at the Hotel Utah. J. M. Perlewitz, president of the Electrical League of Utah, which sponsored the affair, opened the meeting, which was addressed by prominent business men. In the evening dinner was served to about 450, followed by an address on "Engineering in Modern Business," by C. E. Skinner, assistant director of engineering, Westinghouse Electric & Manufacturing Company. P. B. Garrett, San Francisco, gave a demonstration of "Televox." G. M. Gadsby, president Utah Power & Light Company, acted as toastmaster.

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HOOD RIVER, ORE., CONTEMPLATES A MUNICIPAL PLANT.—As a preparatory movement in carrying out previously announced plans for the creation of a publicly owned and operated electric light and power system in the city of Hood River, Ore., members of the Hood River Valley Fruit Growers' Association have filed an application with the state engineer for a permit to appropriate 400 sec.-ft. of water from Hood River for the purpose of developing 10,000 hp. The understanding is that, after the power source shall have been secured, the city will assume responsibility for the construction of the plant and transmission lines and their operation. At present the Pacific Power & Light Company is serving this field.

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WORK BEGINS ON EASTERN NEW JERSEY POWER PLANT AT SAYREVILLE.—Ground has been broken at Sayreville, N. J., for the 60,000-kw. generating plant of the Eastern New Jersey Power Company, subsidiary of the Utilities Power & Light Corporation of Chicago. This plant, as already reported, will contain two 30,000-kw. turbo-generators, eventually to be increased to six as demand increases. It will be built on the main channel of the Raritan River. Steam will be at 400-lb. pressure and a total temperature of 700 deg. F. It will be supplied by four boilers of 12,000-sq.ft. surface, stoker-fired and equipped with air preheaters, economizers, forced-draft and induced-draft fans. The plant, which will cost $6,000,000, is intended for service by April 1 of next year.

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EDISON OFFERS A SCHOLARSHIP.—Charles Edison, son of the inventor, announces that his father has offered a free college scholarship, consisting of all tuition fees for four years, to the high school or preparatory school student who gives the best answers to one of his questionnaires and "who perhaps will have the genius to carry on the great work he has so well started." The governor of each state and the commissioners of the District of Columbia will be asked to designate one male student who evidences high ability in scientific subjects during the school year 1928-29. Each of the 49 winners will receive a trip at Mr. Edison's expense to the Edison Laboratories, where the examination will be conducted.

## *Coming Meetings*

[A complete directory of electrical associations, with their secretaries, is published in the first issue of every volume. For latest list see issue for January 5, page 80.]

American Institute of Electrical Engineers—Regional meeting, Dallas, Tex., May 7-9; summer convention, Swampscott, Mass., June 24-28. F. L. Hutchinson, 33 West 39th St., New York.

East Central Division, N.E.L.A.—Louisville, Ky., May 7-10. D. L. Gaskill, Greenville, Ohio.

Southeastern Division, N.E.L.A.—Asheville, N. C., May 8-10. C. M. Kilian, 207 Bona Allen Bldg., Atlanta.

Missouri Association of Public Utilities—Bothwell Hotel, Sedalia, May 16-18. F. D. Beardslee, 315 N. 12th St., St. Louis.

National Electrical Credit Association—Statler Hotel, St. Louis, May 16 and 17. F. P. Vose, 1008 Marquette Bldg., Chicago.

National Electrical Manufacturers' Association—The Homestead, Hot Springs, Va., May 20-25. S. N. Clarkson, 420 Lexington Ave., New York.

American Electrochemical Society—Toronto, May 27-29. C. G. Fink, Columbia University, New York.

National Electrical Wholesalers' Association—The Homestead, Hot Springs, Va., May 27-31. E. Donald Tolles, 165 Broadway, New York.

National Electric Light Association—Atlantic City, N. J., June 3-7. A. J. Marshall, 420 Lexington Ave., New York.

North Central Electric Association—Breezy Point, Pequot, Minn., June 16-18. J. W. Lapham, 803 Plymouth Bldg., Minneapolis.

Association of Iron and Steel Electrical Engineers—Pittsburgh, June 17-21. J. F. Kelly, 1007 Empire Bldg., Pittsburgh.

Canadian Electrical Association—Algonquin Hotel, St. Andrew's by the Sea, N. B., June 19-21. H. M. Lyster, 712 Power Bldg., Montreal.

Pacific Coast Electrical Association—Del Monte, Calif., June 19-22. S. H. Taylor, 447 Sutter St., San Francisco.

Society for the Promotion of Engineering Education—Ohio State University, Columbus, June 19-22. F. L. Bishop, University of Pittsburgh, Pittsburgh.

Northwest Electric Light and Power Association—Seattle, June 26-29. B. Snow, 1206 Spalding Bldg., Portland, Ore.

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MASTER-METER QUESTION COMING UP IN ILLINOIS.—The Illinois Commerce Commission will hold a hearing soon upon whether or not a utility corporation is required to install one large meter in office buildings to make it possible for the owners to retail electricity to their tenants. The case is coming up on complaint of Rockford office owners that the Rockford Electric Company has refused to permit that system to be used. Adam Gschwindt, general manager of the Rockford Electric, quotes two commission rulings from other states which refused to allow such installations and argues that before the building owners can enter the electric retailing field they must obtain certificates of convenience and necessity from the commission.

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DAYTON AND SPRINGFIELD (OHIO) PLANTS TO BE INTERCONNECTED.—An agreement for interconnection of the high-tension lines of the Dayton (Ohio) Power & Light Company with the lines of the Ohio Edison Company, Springfield, for sale of power to the Springfield company and protection of both systems against emergency shortages has been announced by O. H. Hutchings, vice-president of the Dayton company. There are no corporate affiliations between the two utilities. When lines connecting the Springfield and Dayton plants are completed their combined capacity will be more than 500,000 hp., inasmuch as the Dayton company is already interconnected with the system of the Union Gas & Electric Company of Cincinnati.

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MCGRAW-HILL ORGANIZATION TAKES OVER SPANISH-LANGUAGE ELECTRICAL PERIODICAL.—*Electricidad en America*, the only magazine in Spanish published in New York devoted exclusively to electrical interests, has been purchased by the Business Publishers' International Corporation, the foreign unit of both the McGraw-Hill Publishing Company and United Business Publishers, Inc. The May issue comes out under the new management, and with the July issue the magazine will pass under the editorship of Wallace Thompson, who is also chief editor of *Ingeniería Internacional*, the Spanish engineering magazine. *Electricidad en America* is the twenty-sixth magazine to take its place in the McGraw-Hill organization.

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NIAGARA, LOCKPORT & ONTARIO POWER TO BUILD ANOTHER PLANT ON SALMON RIVER.—Proposals for a 10,000-hp. hydro-electric project on the Salmon River at Altmar, Oswego County, N. Y., have been asked by the Niagara, Lockport & Ontario Power Company, which already has a 40,000-hp. plant at that site. The cost of the new development will be approximately $1,500,000, and the probable date of completion is March

1, 1930. This company is carrying out a large reforesting project on its property in Oswego County, above the power dam, 500,000 trees having been set out with 600,000 more in prospect.

CARRYING ELECTRICITY TO MAMMOTH CAVE.—A 15-mile transmission line is to be built by the Kentucky Utilities Company from Horse Cave, Ky., to Mammoth Cave. It will be constructed to carry 33,000 volts, though a much lower voltage will probably be used at present. The new line will light the hotel and some of the smaller caves in the vicinity as well as supply energy to farms. Mammoth Cave itself will not be electrified at present, but if the property is turned over to the government as a national park, as it is planned to do, it is likely eventually to be wired, despite the complicated nature of the work and its expense, figured at from $60,000 to twice that sum.

TURNERS FALLS COMPANY PROPOSES CUT IN CHICOPEE RATES.—The Turners Falls Power & Electric Company has submitted to the city of Chicopee, Mass., an amendment to the existing contract, which expires in 1936, that proposes a reduction in the price of energy from 16 mills per kilowatt-hour to 14½ mills. Embodied in the amendment is an optional provision that the city may accept a Hopkinson scale rate involving the monthly payment of $1.75 per kilowatt held available for the city's consumption as based on maximum demand, which is approximately 3,500 kw. Beyond this figure, if the Hopkinson plan were adopted, the city would pay 9 mills per kilowatt-hour for all energy consumed. It is estimated that by this schedule the city would effect a saving of about $20,000 annually. This amended contract would be extended to 1944.

EFFORT TO ADJUST SITUATION AT ELKINS, W. VA.—Although the city of Elkins, W. Va., at the general municipal election held on March 5, authorized the issuance of $135,000 in bonds for the construction of a municipal electric and power plant, the bonds have not yet been sold pending approval of their validity by the Attorney General of the state. Their legality is attacked. In the meantime R. Paul Smith, vice-president of the American Waterworks & Electric Company, of which the utility now serving Elkins, the Monongahela-West Penn Public Service Company, is a subsidiary, has held several conferences with the Elkins City Council and the special lighting committee of that body in an effort to compose rate differences covering a period of about two years. So far there has been no definite outcome. The power company, however, will continue its service, apparently, even if a municipal plant is installed. The Monongahela-West Penn company early in March announced a general reduction in rates not only for Elkins but for all communities in the Flemington region, the new rate being of the promotional type.

ENGINEERING APPOINTMENTS WILL AID STUDY OF BOULDER DAM.—Studies preliminary to the construction of Boulder Dam are in active progress, it is stated by R. F. Walter, chief engineer of the Bureau of Reclamation. Secretary Wilbur of the Department of the Interior has appointed three outstanding engineers as consultants in the field service and particularly upon the problems of the Boulder Canyon project operation. These are Louis C. Hill of Colorado, Andrew J. Wiley of Idaho and William F. Durand of California. Mr. Hill was long in the service of the Bureau of Reclamation. He supervised the construction of Roosevelt Dam, Elephant Butte Dam, Laguna Dam and other important irrigation structures. Mr. Wiley has had a large experience in constructing irrigation systems, power plants and related works and has specialized in building dams. His reputation is international. Mr. Durand, who was for years a professor in the Engineering School at Stanford University, has participated in former studies of the Colorado River made by the Reclamation Bureau.

## Recent Court Decisions

"EQUAL PROTECTION" AS A CONSTITUTIONAL RIGHT IN COMPETITION.—The exemption by the laws of Oklahoma of "co-operative ginning companies" composed of farmers from the state law declaring cotton gins to be public utilities and subject to license and regulation has been overthrown by the United States Supreme Court on the ground that the "equal protection" clause of the Fourteenth Amendment makes it unconstitutional to permit competition in a regulated industry in some instances and not in others. In Frost vs. Oklahoma Corporation Commission the highest court held that Frost, a licensed cotton-gin operator, was entitled to an injunction against his agricultural competitors. In the opinion of the *Public Utilities Fortnightly*, "this decision is of vast significance, because many utilities may now find that protection from competition is a constitutional right and not, as some have thought heretofore, merely a gratuitous favor from the state."

CHICAGO'S PETITION TO INTERVENE IN CASE AFFECTING DIVERSION OF LAKE WATER.—The United States Supreme Court has denied the petition of the city of Chicago to intervene as defendant in the hearings before the special master on the Illinois case concerning diversion of water from Lake Michigan. In a brief submitted by counsel for the city requesting permission to intervene it was stated that a new water-supply system costing $123,000,000 would have to be built if sewage were discharged into the lake, "even if such sewage is artificially treated to the greatest practicable extent known to the art. In addition it would be necessary to change the sewage system into two separate units, one for the drainage and one for the sewage. The cost of this change was estimated to be $330,000,000. The city is without means to finance so extensive a construction program for its waterworks and sewer system, it protested. As to the amount that will be required to construct sewage purification works, the brief estimates this at "upward of $176,000,000." Moreover, it was stated that the discharge of artificially treated sewage and storm water into the lake would damage utility companies in the city to the extent of $186,000,000 by depriving them of condensing water for their various plants on the Chicago river. This loss would be reflected in higher rates.

## Commission Rulings

ALTERNATING - CURRENT CUSTOMERS SHOULD NOT BEAR COST OF OTHERS' CHANGE TO DIRECT CURRENT.—Sixty days was granted to the Alabama Power Company by the Alabama Public Service Commission to determine whether a plan could be formulated whereby consumers of electrical energy in Mobile might accept alternating current at a reduction in their bills. The decision to grant the time was reached by the commission following a hearing on a case preferred against the power company by the city of Mobile. The commission's action, the ruling set forth, was based on a statement of a power company representative at a hearing in Birmingham recently that the company had sought to aid its customers in changing from direct to alternating current and in some instances had assisted in defraying the cost of installing alternating equipment. "Upon consideration of all evidence in the case," the ruling said, "the commission is of the opinion that there is a substantial difference in the cost of renting direct-current and alternating-current service to the city of Mobile. The records show that some direct-current customers are changing over to alternating current because of the economy effected. The commission believes that equitably this additional cost should be borne by those using the direct-current service rather than placing a portion of the burden of this additional cost on the alternating-cost customers."

PURCHASE OF MUNICIPAL PLANT DID NOT GIVE UTILITY COMPANY THE RIGHTS BELONGING TO SUCH PLANTS.—The municipal plant at Sedgwick, Colo., was recently sold to the Public Service Company of Colorado. The latter obtained a certificate of convenience and necessity from the Public Utilities Commission and asked authority to construct a new plant. The adjoining municipal plant of Julesburg, which had sold energy to the Sedgwick plant, protested. The commission admitted Julesburg's right to consideration, saying: "It is true that the town of Sedgwick could, without any authority from this commission, have constructed its own plant, but the mere fact that the town of Sedgwick could have constructed a plant without authority from this commission does not mean that the vendee of its distribution system could do the same. The reasons why a town needs no authority and a private corporation does need authority to construct a plant have been set forth in the cases decided by the Supreme Court of this state. Reasons why the authority is needed in the case of a private corporation apply with the same force in the case of a utility whose property has been purchased from a municipality as in any other case."

# News About Men of the Industry

## *C. A. Adams Receives Miller Medal*

Comfort A. Adams, professor of electrical engineering at Harvard University, to whom was awarded the Samuel Wylie Miller medal for 1927 for his work in the advancement of welding as a mechanical art, as announced in the April 27 issue of the ELECTRICAL WORLD, has been recognized as an authority on welding practices for a number of years. Professor Adams has devoted considerable attention to his academic duties, but he has not refrained from active participation in industry, in the course of his career having been retained as consulting engineer by a number of commercial and public utility companies.

He was largely responsible for the organization of the American Engineering Standards Committee and served as chairman of the organization committee as well as first chairman of the committee itself. He was the first president of the American Welding Society and the first director of the American Bureau of Welding. Professor Adams is a past-president of the American Institute of Electrical Engineers and long has been extremely active in its affairs, being at the present time a member of the electric welding committee.

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ANDREW W. ROBERTSON, chairman of the board of directors of the Westinghouse Electric & Manufacturing Company, has been elected a director of the Chase National Bank of New York.

W. C. BLACKWOOD, formerly electrical engineer with the New York & Queens Electric Light & Power Company, has recently joined the Otis Elevator Company, New York.

E. B. GLAZIER, manager of the industrial development department of the West Penn Power Company, has resigned. Mr. Glazier will join the American & Foreign Power Corporation in Havana, Cuba. Since December 1, 1924, he has served as head of the industrial development department of the company and prior to that he was superintendent in the Scottdale and Mount Pleasant districts for two years. WALTER H. KELLY of Pittsburgh has been appointed manager of the industrial development activities to succeed Mr. Glazier. He has been assistant in the department for the last year and a half and prior to that was connected in an engineering capacity with many of the West Penn interests since 1920.

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## *W. A. King Directs Distribution for Penn-Ohio System*

William A. King has been appointed superintendent of electrical distribution of the Pennsylvania-Ohio System, according to Frank W. Funk, chief engineer of the company. The position is a newly created one. Mr. King becomes identified with the Penn-Ohio company after leaving Flint, Mich., where he held a similar position with the Consumers Power Company. His home was in Manistee, Mich., where he received his early education and where he first entered the electric service company's employ as storekeeper, in 1913. Since that time he has been with the Consumers organization continuously, having been promoted at Manistee to the position of assistant to the district manager. He removed to Jackson, Mich., in 1917 as engineer in the distribution department and in 1919 he transferred his interests to Flint. Mr. King will make his headquarters in Youngstown, Ohio.

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LEE A. SMITH, who has been connected with the engineering department of the El Paso Electric Company, has been named assistant to the general superintendent of light and power of that company to succeed H. T. Burnam, who has assumed new duties in the company's sales department.

GEORGE L. CARLISLE has been appointed vice-president and general manager of the Champion Switch Company of Kenova, W. Va. Mr. Carlisle has had wide experience in the public utility field, having spent nine years with the West Penn Power Company. Prior to that connection he was engaged in consulting engineering work, principally in connection with mining developments.

H. H. HORSFALL has been appointed president of the Lake St. John Power & Paper Company, succeeding the late E. A. Wallberg. Mr. Horsfall, who has occupied the position of vice-president for some time, was associated with Mr. Wallberg for many years. He is also president of the newly formed Canada Wire & Cable Company and is on the directorate of General Steel Wares.

## *James Kennedy President of Southwestern Utility*

Building communities with which he has had contact is almost a hobby with James C. Kennedy, newly elected president of the Central & South West Utilities Company. In a quiet but effective way he has been active in many parts of the Southwest and successful in the work of strengthening the "human" relationship between the utility companies with which he is connected and the public they serve. His election to the presidency of the Central & South West Utilities Company came after he had served as active vice-president since it was organized several years ago. When serving as vice-president of that company he also served as president of the Central Power & Light Company, president of the Southwestern Gas & Electric Company and director of the West Texas Utilities Company, Southwestern Light & Power Company and Public Service Company of Oklahoma. Recently he was made vice-chairman of the four first named and is serving as director of the Public Service Company of Oklahoma.

Indianapolis was Mr. Kennedy's birthplace, but he has lived in the South since early life and in Texas for 25 years. He worked his way through college by doing electrical wiring outside of school hours. After completing his college work he spent several years in Central America.

The first power plant in Gulfport, Miss., was built by Mr. Kennedy, for the Gulfport Development Company. Later he engaged in electrical and civil engineering practice in Texas and Mexico, returning to the executive and operating field at Brenham, Tex., as secretary and manager of the electric utilities at that place. Upon his discharge from the army after the World War he joined the organization of the Middle West Utilities System as operating official of the American Public Service Company at Dallas, Tex.

## *Gaylord Made Vice-President of Westinghouse Company*

T. P. Gaylord, formerly acting vice-president of the Westinghouse Electric & Manufacturing Company, has been elected a vice-president of that organization. Mr. Gaylord first became identified with the Westinghouse interests in 1899 and after a period of three years he was appointed district manager with offices in Chicago. In 1914 he was made acting vice-president and he moved at that time to East Pittsburgh.

Mr. Gaylord was born in Shelby,

Mich., in 1871 and received his technical training at the University of Michigan, from which institution he was graduated with the degree of electrical engineer. He also received a degree from the Armour Institute of Technology in 1895. Before affiliating himself with the Westinghouse Electric & Manufacturing Company Mr. Gaylord became assistant professor of electrical engineering at the Armour Institute, serving there from 1893 to 1898. He was engineer of the Chicago Edison Company from 1898 to 1899 and then entered the employ of the Westinghouse company. Mr. Gaylord is a member of the American Institute of Electrical Engineers, a director in the Pittsburgh Chamber of Commerce and a member of the Chamber of Commerce of the United States.

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CHARLES M. SANFORD has been appointed assistant general manager of the Pacific Power & Light Company, Portland, Ore., to succeed George C. Sawyer, who resigned to join the organization of the Electric Bond & Share Company in New York. Mr. Sanford has been connected with various electrical interests in the West since 1906. The Pacific Power & Light Company placed him in charge of its tax department in January, 1927, and since then his responsibilities have increased until they now include those of assistant general manager.

LESLIE M. MATHER has joined the organization of Gannett, Seelye & Fleming, Inc., to be general superintendent of its properties in Argentina, South America. These properties are a part of the Intercontinents Power Company and Mr. Mather will have his headquarters at the main offices in Buenos Aires. He was formerly with the J. G. White Corporation and later with the Pennsylvania Power & Light Company.

EWING E. TOWLES, assistant chief engineer for the Missouri Public Service Commission at Jefferson City, has resigned, to affiliate himself with the American States Electric Company of Chicago in the capacity of vice-president. He is a graduate of the Missouri University, school of engineering. Mr. Towles became assistant chief engineer for the commission in 1914 and was later granted a leave of absence to serve in the Signal Corps of the army during the World War. Following military service he resumed his duties with the commission.

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## *H. Carl Wolf Resigns from Maryland Commission*

H. Carl Wolf, chief engineer of the Public Service Commission of Maryland, has resigned to become affiliated with the Central Public Service Company with headquarters in Chicago. Mr. Wolf severed his connection with the commission after an association that covers a period of eight years, one of which was spent in the capacity of assistant chief, and seven as chief engineer. Early in his career he served for two years as assistant engineer of the Illinois Commerce Commission and during the war he engaged in the design, estimating and construction of power plants and equipment, transmission and distribution lines in France. In 1920 Mr. Wolf removed to Baltimore to make a study of the organization and personnel conditions in the state of Maryland for Governor Ritchie and later his appointment to the commission followed.

During his occupancy of the position of chief engineer he became thoroughly familiar with the electrical industry in Maryland, having prepared valuations of practically all the utility properties in the state. In his new position Mr. Wolf will be assistant to the operating vice-president in charge of gas operations. He is a director of the Baltimore section of the American Institute of Electrical Engineers and president of the Engineers' Club of Baltimore.

JOSEPH F. PORTER, president of the Kansas City Power & Light Company, Kansas City, Mo., has been elected a member of the board of directors of the St. Louis Southwestern Railway Company.

WILLIAM DEXTER was elected a member of the board of directors and RODOLPHE L. AGASSIZ was elected a member of the executive committee of the Edison Electric Illuminating Company of Boston to fill vacancies caused by the resignation of Charles F. Adams.

A. W. KOINER, sales manager of the Taylor Colquitt Company, timber preservers of Spartanburg, S. C., has resigned following a connection which covered a period of two years. Mr. Koiner formerly specialized in Western red cedar poles with the Lindsley Brothers Company, Minneapolis, and when that organization sold out two years ago Mr. Koiner transferred his interests to the pine pole industry.

# Obituary

ROYDON R. DOUGLAS, electrical engineer, who founded the Douglas Electric Construction Company of New Orleans and directed its affairs until September, 1927, died in Alexandria, La., April 18 following an illness covering a period of three years. A native of Manchester, England, Mr. Douglas came to this country in his early twenties. After he established residence in New Orleans he became interested in electrical development and the Douglas Construction Company resulted. Mr. Douglas was 62 years of age.

EDMUND PERKINS EDWARDS, 52, manager of the radio department of the General Electric Company since its organization in 1921, died April 27 at his home in Schenectady, N. Y. Born in Louisville, Ky., in 1877, he attended the Rose Polytechnic Institute at Terre Haute, Ind., from which he was graduated in 1899. He then became associated with the General Electric Company in the meter department and in 1907 he was transferred to the lighting department, of which he became assistant manager in 1912.

THOMAS F. QUIGLY, superintendent of the Yuma Utilities Company, Riverside, Cal., an executive of the Southern Sierras Power Company of Mexico, and in charge of the Colorado River substation of the Southern Sierras Company, died April 18 in Yuma as a result of influenza. Mr. Quigly was born in Portwine, Cal., in 1892 and prior to his connection with the Southern Sierras, beginning in 1914, he was affiliated with the Coast Counties Power Company at Gilroy, Cal. Mr. Quigly was indefatigable in obtaining data contributory to the growth of the power industry, and in civic enterprise and responsibility few men have equaled his local record.

# Financial and Statistical News

APRIL CLOSED with the usual month-end stiffening of money rates a few days earlier than usual, due, presumably, to the coincidence of the week-end adjustment of member banks' reserve positions with month-end settlements. The call rate of 16 per cent was the second highest rate this year.

——THE PAST MONTH has set up unusually low totals, both in new financing and in volume of trading in the securities markets. The former dropped to around $35,000,000, including rights issued to shareholders. The issue of rights has totaled approximately $100,000,000 this year to date.

——STOCKS GENERALLY CLOSED HIGHER, with some substantial advances. There has been considerable buying in Allied Power & Light and United Corporation. Some of the Electric Bond & Share stocks, especially American & Foreign Power, American Power & Light and Electric Investors, have made notable gains.

## United Public Utilities Makes Bond Offering

First lien 6 per cent gold bonds, series C, of the United Public Utilities Company were offered May 1 at 99 and interest, yielding more than 6.05 per cent, a piece of financing involving a total of $1,000,000. Each bond carries a non-detachable warrant entitling the holder to purchase on or before April 1, 1934, at $15 a share, common stock without par value of the United Public Service Company in the ratio of ten shares of common stock for each $1,000 principal amount of bonds. The United Public Utilities Company is a New Jersey corporation which controls, through stock ownership, operating subsidiaries furnishing public utility service to 63 cities in the territory between Dayton, Ohio, and Winchester, Ind., and to 83 cities in North and South Dakota.

## Electricity, Coal and Water Power in Czechoslovakia

The present installed capacity of electric power stations in Czechoslovakia is 830,000 kw., with an output of 13,000,000,000 kw.-hr. yearly, or 96 kw.-hr. per capita, says the *V.D.I. Nachrichten* in a recent issue. The steam stations are in keen and apparently effective competition with the hydro stations, one costly wartime hydro station producing only a hird of its potential output.

Of the estimated total available water power, 1,267,000 kw., there has been developed 114,000 kw., leaving 1,153,000 kw. awaiting development. Some of this development is now in process or projected for the near future, to the extent of 152,000 kw., with an estimated yearly output of 600,000,000 kw.-hr.

In part this will be achieved by the canalization or regulation of important navigable streams. Improvements in one section of the Elbe are expected to yield 226,000,000 kw.-hr. yearly; on another section, 88,000,000 kw.-hr. The plant for the latter, with a capacity of 22,800 hp., must be in service in the year 1932. Its cost is estimated at $4,500,000.

The Moldava is to yield 700,000,000 kw.-hr. yearly. A combination of flood protection, hydro and mouth-of-the-mine steam plant with the central heating and power station at Brunn, the last-named supplying low pressure steam to the textile industries, is expected to save 10,000 tons of coal yearly and to produce 30,000,000 kw.-hr. in addition. The dam (Thaya) will store 5,900,000,000 cu.ft. of water. On the Waag River a 175,000-hp. hydro plant, to be used for fixation of nitrogen, is under construction.

Czechoslovakia stands third in her production and sixth in her coal reserves among the countries of Europe. In order to save on the transportation of fuel, her largest power stations are built directly at the coal mines. This also offers the possibility of firing low grade coals in powdered form, which are useless for other purposes.

BALTIMORE UTILITY CALLS BONDS.—The Consolidated Gas, Electric Light & Power Company of Baltimore has called for payment its first refunding 6 per cent bonds, series A, due in 1949. The issue amounts to the sum of $10,531,000.

## Utility Groups Settle Dispute Over General Gas & Electric

### United Gas Improvement Sells Its Holdings to Associated Gas & Electric, Closing Incident Which Threatened Break Between Two Large Power Systems

WITH the purchase by the Associated Gas & Electric Company from the United Gas Improvement group of all of the latter's holdings in General Gas & Electric an incident which threatened to disrupt amicable relations between two of the large utility groups is closed. The Associated system is acquiring the stock held by the Gas Securities Corporation, a United Gas Improvement subsidiary. The settlement just reached suggests a brief résumé of the incidents of the case for record purposes.

Last fall representatives of the United Gas Improvement Company entered into negotiations with W. S. Barstow & Company for the purchase of the latter company for 317,295 shares of its stock. This transaction was not consummated, however, but the United Gas Improvement Company gradually acquired an interest in General Gas & Electric direct. By the end of 1928 it held through Gas Securities Corporation:

| | Shares | Per Cent of Total |
|---|---|---|
| Class A stock | 306,239 | 83.7 |
| Class B stock | 81,061 | 35.3 |
| Dividend participations | 298,761 | 78.5 |

This constituted an interest of about 59 per cent in the earnings of the General Gas & Electric Corporation applicable to common stocks and dividend participations.

In February, 1929, the Associated Gas & Electric Company announced that it was acquiring all of the stock of W. S. Barstow & Company, Inc., which would give a substantial majority of the voting stock of General Gas & Electric Corporation. The class B shares of General Gas & Electric thus acquired carried with them control of the system. W. S. Barstow and William Buchsbaum, who were president and vice-president, respectively, of General Gas & Electric, became directors of Associated Gas & Electric Company.

Notwithstanding the announcement United Gas Improvement Company is stated to have continued accumulation of General Gas stock. Associated Gas & Electric Company thereupon took for permanent investment a further block of unissued B stock to the extent of 170,000 shares at $95 a share. Associated Gas also acquired directly interests in a group of General Gas & Electric subsidiaries, including Binghamton Light, Heat & Power, Metropolitan Edison, New Jersey Power & Light, Northern Pennsylvania Power and other small companies in process of being merged with them.

## *Current Earnings Reports of Electric Light and Power Companies*

| | 1929 | 1928 | Per Cent Increase | Operating Ratio 1929 | Operating Ratio 1928 |
|---|---|---|---|---|---|
| **American Water Works & Electric & Subs.** (Year ended Feb. 28) | | | | | |
| Gross earnings | $51,439,063 | $49,034,313 | 4.9 | 51 | 53 |
| Net earnings | 25,353,298 | 22,960,118 | 10.4 | .. | .. |
| **Bangor Hydro-Electric** (Year ended Feb. 28) | | | | | |
| Gross earnings | 1,984,152 | 1,881,770 | 5.4 | 46 | 46 |
| Net earnings | 1,077,677 | 1,015,614 | 6.1 | .. | .. |
| **Baton Rouge Electric** (Year ended Feb. 28) | | | | | |
| Gross earnings | 1,139,207 | 1,041,345 | 9.3 | .. | .. |
| Net earnings | 428,448 | 377,578 | 13.5 | .. | .. |
| **Blackstone Valley Gas & Electric & Subs.** (Year ended Feb. 28) | | | | | |
| Gross earnings | 6,177,080 | 5,946,189 | 3.9 | .. | .. |
| Net earnings | 2,485,906 | 2,169,596 | 14.5 | .. | .. |
| **Columbus Electric & Power & Subs.** (Year ended Feb. 28) | | | | | |
| Gross earnings | 4,310,062 | 4,305,390 | 0.1 | .. | .. |
| Net earnings | 2,340,508 | 2,385,146 | —1.8 | .. | .. |
| **Carolina Power & Light** (Year ended Jan. 31) | | | | | |
| Gross earnings | 9,032,092 | 8,941,975 | 1.0 | 47 | 53 |
| Net earnings | 4,768,107 | 4,147,133 | 15.0 | .. | .. |
| **Cities Service** (Year ended Feb. 28) | | | | | |
| Gross earnings | 35,667,495 | 32,951,844 | 8.2 | .. | .. |
| Net earnings | 34,493,296 | 31,840,374 | 8.3 | .. | .. |
| **Commonwealth Power & Subs.** (Year ended March 31) | | | | | |
| Gross earnings | 59,962,170 | 54,507,811 | 10.0 | 51 | 53 |
| Net earnings | 29,176,932 | 25,524,859 | 14.3 | .. | .. |
| **Consumers Power** (Year ended Feb. 28) | | | | | |
| Gross earnings | 31,153,778 | 27,245,543 | 14.3 | 49 | 51 |
| Net earnings | 15,810,997 | 13,285,161 | 19.0 | .. | .. |
| **Detroit Edison** (Year ended March 31) | | | | | |
| Gross earnings | 53,672,283 | 48,500,352 | 10.7 | 65 | 67 |
| Net earnings | 18,698,270 | 16,078,990 | 16.3 | .. | .. |
| **El Paso Electric** (Year ended Feb. 28) | | | | | |
| Gross earnings | 3,238,792 | 3,026,888 | 7.0 | .. | .. |
| Net earnings | 1,315,432 | 1,173,121 | 12.1 | .. | .. |
| **East Texas Electric & Subs.** (Year ended Feb. 28) | | | | | |
| Gross earnings | 8,266,433 | 7,325,083 | 12.8 | .. | .. |
| Net earnings | 3,403,620 | 2,662,119 | 27.9 | .. | .. |
| **Engineers Public Service** (Year ended Feb. 28) | | | | | |
| Gross earnings | 36,091,385 | 29,828,555 | 21.0 | 58 | 61 |
| Net earnings | 15,078,100 | 11,587,180 | 30.6 | .. | .. |
| **Florida Power & Light** (Year ended March 31) | | | | | |
| Gross earnings | 1,269,799 | 1,190,891 | 6.6 | 48 | 52 |
| Net earnings | 657,290 | 574,456 | 14.4 | .. | .. |
| **Federal Light & Traction & Subs.** (Year ended Feb. 28) | | | | | |
| Gross earnings | 8,062,911 | 7,135,020 | 13.0 | 59 | 62 |
| Net earnings | 3,315,505 | 2,694,602 | 23.0 | .. | .. |
| **Idaho Power** (Year ended Feb. 28) | | | | | |
| Gross earnings | $3,561,023 | $3,325,895 | 10.0 | 47 | 48 |
| Net earnings | 1,878,755 | 1,691,773 | 11.0 | .. | .. |
| **Illinois Power & Light & Subs.** (Year ended Jan. 31) | | | | | |
| Gross earnings | 35,138,108 | 31,329,278 | 12.1 | 52 | 60 |
| Net earnings | 15,242,045 | 12,504,760 | 21.8 | .. | .. |
| **Kansas City Power & Light** (Year ended March 31) | | | | | |
| Gross earnings | 13,976,936 | 13,025,022 | 6.5 | 51 | 51 |
| Net earnings | 6,832,248 | 6,410,969 | 7.3 | .. | .. |
| **Nevada-California Electric & Subs.** (Year ended Feb. 28) | | | | | |
| Gross earnings | 5,512,981 | 5,143,791 | 7.2 | 44 | 45 |
| Net earnings | 3,079,578 | 2,852,964 | 7.9 | .. | .. |
| **New York Power & Light** (Year ended Mar. 31) | | | | | |
| Gross earnings | 20,789,901 | 19,286,361 | 7.8 | 56 | 59 |
| Net earnings | 9,048,000 | 7,798,228 | 16.0 | .. | .. |
| **Penn-Ohio Edison, Northern Ohio Power** (Year ended Feb. 28) | | | | | |
| Gross earnings | 28,059,821 | 26,550,797 | 5.7 | 60 | 63 |
| Net earnings | 11,237,999 | 9,656,485 | 16.4 | .. | .. |
| **Portland Electric Power** (Year ended Feb. 28) | | | | | |
| Gross earnings | 12,586,026 | 12,201,970 | 3.1 | 60 | 59 |
| Net earnings | 5,084,985 | 4,989,076 | 1.9 | .. | .. |
| **Puget Sound Power & Light & Subs.** (Year ended Feb. 28) | | | | | |
| Gross earnings | 15,345,109 | 14,961,978 | 2.6 | .. | .. |
| Net earnings | 6,465,792 | 6,455,627 | 0.5 | .. | .. |
| **Savannah Electric & Power** (Year ended Feb. 28) | | | | | |
| Gross earnings | 2,226,173 | 2,228,751 | —0.1 | .. | .. |
| Net earnings | 1,004,111 | 929,646 | 8.0 | .. | .. |
| **Sierra Pacific Electric & Subs.** (Year ended Feb. 28) | | | | | |
| Gross earnings | 1,411,349 | 1,258,451 | 12.2 | .. | .. |
| Net earnings | 641,088 | 591,995 | 8.3 | .. | .. |
| **Southern California Edison** (Year ended Feb. 28) | | | | | |
| Gross earnings | 36,098,792 | 31,059,846 | 16.0 | 34 | 33 |
| Net earnings | 23,712,336 | 20,936,228 | 3.0 | .. | .. |
| **Tampa Electric & Subs.** (Year ended Feb. 28) | | | | | |
| Gross earnings | 4,639,689 | 4,693,978 | —0.1 | .. | .. |
| Net earnings | 1,461,574 | 1,504,669 | —2.9 | .. | .. |
| **Tennessee Electric Power** (Year ended Feb. 28) | | | | | |
| Gross earnings | 13,569,178 | 12,664,657 | 7.1 | 51 | 54 |
| Net earnings | 6,606,054 | 5,779,655 | 14.3 | .. | .. |
| **Utah Power & Light** (Year ended Feb. 28) | | | | | |
| Gross earnings | 11,199,849 | 10,632,078 | 5.0 | 49 | 49 |
| Net earnings | 5,755,053 | 5,474,760 | 5.0 | .. | .. |

United Gas Improvement Company through its subsidiary, the Gas Securities Corporation, then asked the Superior Court of Delaware for a writ of mandamus against General Gas & Electric, maintaining that information given to shareholders was "misleading, evasive, inadequate and intentionally secretive" in respect to new capitalization plans. Full access to the books of the company was asked.

At this point, however, negotiations were made and the settlement already referred to was arrived at out of court. It is understood that Associated Gas & Electric Company offered to purchase its opponent's entire holdings in General Gas for an amount approximating $40,000,000, and that a settlement was reached on this basis.

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EMPIRE PUBLIC SERVICE NAMES DIRECTORATE.—The board of directors of the Empire Public Service Corporation, organized early this year, has been announced as follows: A. S. Dewing, W. Findlay Downs, E. A. Feldtkeller, Richard C. Hunt, J. A. W. Inglehart, C. S. Newhall, W. Bruce Pirnie, Robert W. Rea, Ezra Whitman, Floyd W. Woodcock, H. C. Yeager and F. W. Young. The directors declared an initial quarterly dividend of 45 cents on the class A common stock. Upon application to the company stockholders can apply this dividend to the purchase of additional class A common stock at $18 a share.

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GERMAN COMPANIES REPORT EARNINGS.—Landkraftwerke Leipzig Aktiengesellschaft in Kulkwitz and Energie Aktiengesellschaft Leipzig, German public utility companies, which issued $3,000,000 bonds in this country in 1926, known as Leipzig Overland Power Companies twenty-year sinking fund 6½ per cent mortgage gold bonds, have reported net earnings for the fiscal years ended June 30, 1927 and 1928, of $1,073,886 and $1,141,277, respectively, before depreciation, provision for replacement of leased properties, profits, taxes and amortization of bond interest. Interest charges on the bonds still outstanding amount to $182,000 a year.

## Commonwealth Power Electric Sales Up

Activity of general business in the territory served by the Commonwealth Power Corporation system is reflected in substantial increases in the consumption of electricity. Sales of electricity in March totaled 166,116,404 kw.-hr., as compared with 150,476,433 kw.-hr. in March, 1928, an increase of 10.39 per cent. For the first three months of 1929 electric sales were 499,975,474 kw.-hr., as compared with 446,500,416 kw.-hr. for the first three months of last year.

| Kw.-Hr. Sales | 1929 | 1928 | Increase Amount | Increase Per Cent |
|---|---|---|---|---|
| Month of March | 166,116,404 | 150,476,433 | 15,639,971 | 10.39 |
| Three months ended March 31 | 499,975,474 | 446,500,416 | 53,475,058 | 11.98 |
| Twelve months ended March 31 | 1,865,955,739 | 1,634,928,831 | 231,026,908 | 14.13 |

## Cities Service Votes Stock Split-Up

Stockholders of the Cities Service Company at a special meeting held April 30 immediately after the annual meeting voted for a split-up of the common stock on a four-for-one basis. Four shares of new no-par stock will be issued for each share of $20 par stock now outstanding, giving the company an outstanding common capitalization of 24,000,000 shares. At the meeting an increase in the number of shares to 50,000,000 was also authorized. The stockholders approved the issuance of $1,000,000 of 5 per cent non-cumulative preferred stock and authorized the directors to issue preferred and preference stock in series as occasion may arise, provided that no such issues shall have dividend rates, redemption prices or voting rights greater than those of the preferred and preference shares now outstanding.

Officials of the Cities Service Company said that the split-up of common shares was in accordance with the policy of the company in keeping its shares within the means of small investors. At the present time the security holders of the company number 450,000, including both bond and stock holders of the company and subsidiaries.

## Growth of the Electric Light and Power Industry

The Institute of Economics, a division of the Brookings Institution of Washington, has just released the results of an investigation of the electric light and power industry, made under the direction of Dr. Charles O. Hardy. The inquiry was based, in part, on a questionnaire sent out by the institute in November, 1927, to 52 of the largest companies, complete replies to which were received from more than half of the entire industry in the United States, and it was based, in part, on all other available sources of information, including reports of the United States Census and of the National Electric Light Association.

Among the findings of the institute are the following:

1. During the period covered by the investigation (1920 to 1927 inclusive) the proportion of electric capacity and electric output of the country by the reporting companies increased from 30 per cent to about 50 per cent.

2. During the period covered by this report the output of the reporting companies increased more rapidly than did their generating capacity. Leaving out the depression period of 1920-21, the increase was from 35.2 per cent in 1922 to 37.9 per cent in 1926.

3. The book value of the electric properties of the reporting companies increased slightly more than did their generating capacity and slightly less than did the actual output of electric energy.

4. The facilities of the reporting companies were utilized a little more fully than were those of other companies.

5. From 1920 to 1927 the ratio of preferred stock to total capitalization doubled; the ratio of common stock and of short-term notes to total capitalization decreased; the proportion of bonds showed little change.

6. The ratio of operating expenses to gross revenue declined from 56.5 in 1920 to 43.6 in 1926.

7. Both the gross revenue and the operating expense per kilowatt-hour increased from 1920 to 1921 and since then have steadily decreased.

8. From 1923 on the ratio of gross revenues to generating capacity declined. The average selling price reported for 1922 was 2.29 cents per kilowatt-hour, as compared with 2.44 cents for the whole industry as reported to the United States Census. The average selling price of the reporting companies had declined to 2.09 cents in 1926.

9. The average annual output per customer of the reporting companies declined from 4,063 kw.-hr. in 1920 to 3,707 kw.-hr. in 1926. The average gross revenue per customer per year declined from $88.43 in 1920 to $77.55 in 1926, a decline of more than 12 per cent.

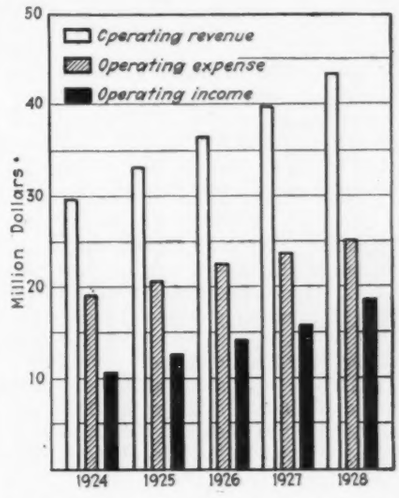
10. The percentage of gross revenue paid out by the reporting companies in taxes amounted to 7.9 per cent in 1922, and it had increased to 8.3 per cent in 1926. Federal increased more than state taxes.

# Philadelphia Electric Reports Further Progress in 1928

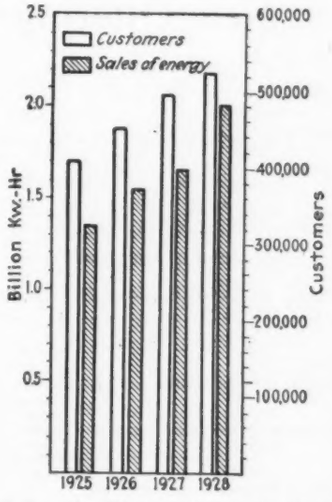
IN THE annual report for the fiscal year ended December 31, 1928, issued to stockholders a few weeks ago, the Philadelphia Electric Company announced another highly successful year. W. H. Taylor, president, said, in part:

"Substantial increases in sales and continued efficiency in operations made the year 1928 one of further progress for your company. The service, particularly with respect to consumers and in the simplification of systems in handling large volumes, was the subject of continued progressive development; advantageous contracts were made with affiliated companies for the sale of increased supplies of energy, and the policy of more closely co-ordinating our activities with those of neighboring utilities in southeastern Pennsylvania and northern Delaware was advanced."

Operating revenue for the past year totaled $43,402,906, as compared with $39,794,340 for the year 1927, and operating income amounted to $18,294,674, as against $15,923,211. These figures represent an increase of 9.1 per cent in gross and 14.0 per cent in net during the twelve-month period. Operating expenses, including renewals and replacements and federal taxes, amounted to $25,108,232, as compared with $23,871,129 in 1927. After interest on funded and unfunded debt and other deductions net income available for dividends and surplus amounted to $12,004,985, as compared with $10,863,088.




*Operating income of Philadelphia Electric shows consistent growth*




*Increase in customers and electrical sales covering four-year period*

During the year 1928, electric customers passed the half million mark and on December 31 numbered 527,682, a gain of 6.55 per cent over the 495,250 connected to the system as of December 31, 1927. Sales of electric energy showed an even greater increase during the twelve months of 1928, amounting to 2,014,333,610 kw.-hr., or 20.87 per cent over the sales for the year 1927. Approximately two-thirds of this increase in business volume is represented by increased amounts of energy delivered to other electric utilities.

Since March 1, 1928, construction work has steadily proceeded on the Conowingo hydro-electric project, until now the project is practically complete in all its essential details directly concerned with the production of electrical energy. The seventh and final unit comprising the initial installation was accepted for operation on July 1, 1928. During the time the several units were in operation in 1928 the plant produced energy in excess of 844,000,000 kw.-hr. No new steam-generating capacity was added to the system during the year. Normal betterments and additions were

made to the transmission, distribution and other facilities of the system to care for the increasing service demands being made upon it. Expenditures for maintenance during 1928 amounted to $1,942,963, approximately 4.5 per cent of the operating revenue. There were placed to the credit of the reserve for renewals and replacements in 1928 $3,482,568 from current earnings and $400,000 from surplus.

## American Commonwealths Power Issues Debentures

The American Commonwealths Power Corporation made an offering of convertible gold debentures to the amount of $4,000,000, the price being 97 and accrued interest, to yield more than 6.25 per cent. These securities, dated May 1, 1929, and maturing May 1, 1949, are convertible at holder's option into class A common stock at $25 per share to and including May 1, 1932, at $30 per share thereafter to and including May 1, 1934, and at $35 per share thereafter to and including May 1, 1939.

BANGOR HYDRO-ELECTRIC ON NEW DIVIDEND BASIS.—Directors of the Bangor Hydro-Electric Company have declared a quarterly dividend of 50 cents per share on the common stock, par $25, payable May 1 to holders of record April 10. This is equivalent to $2 per share on the old common stock of $100 par value, on which quarterly dividends of $1.50 per share had been paid previously.

RECENT LISTINGS.—The New York Stock Exchange has authorized the listing of 256,000 additional shares of common stock (par $25) of the Southern California Edison Company on official notice of issuance and payment in full, pursuant to offer to stockholders, making the total amount applied for to date 2,719,058 shares. There have also been authorized for listing on the big board consolidated mortgage gold bonds of the Rhine-Westphalia Electric Power Corporation to the amount of $19,900,000. These 6 per cent securities (with stock purchase warrants attached) mature August 1, 1953.

## Nevada-California Corporation Offers Stock

For the first time in its history the Nevada-California Electric Corporation is offering its preferred stock for sale to its customers. The stock is 7 per cent non-callable cumulative preferred and is being sold at 107. It has behind it all of the assets of the group of associated subsidiary companies of the Nevada-California Electric Corporation, which includes the Southern Sierras Power Company, the Nevada-California Power Company and the Yuma Utilities Company. The total assets represented by these different companies amount to nearly $50,000,000, as shown in the annual reports to stockholders.

CANADA NORTHERN POWER TO SPLIT SHARES.—The Canada Northern Power Corporation has decided to split its shares on a basis of five to one, following the annual meeting of shareholders and the presentation of the annual report showing net profits of $2,198,737. This will involve a change of capitalization under which 500,000 shares will be authorized, with 375,000 shares outstanding.

AMERICAN SUPERPOWER VOTES RIGHTS.—Directors of the American Superpower Corporation voted May 1 to give to holders of class A and class B common stocks of record of May 8 rights to purchase from it 410,902 shares of common stock of the United Corporation at $30 a share, in the ratio of one United Corporation share for each four shares of A or B common stock of the American Superpower Corporation. The rights will expire on May 24. The directors also voted to call a special meeting of stockholders for June 4 to vote upon proposed amendments to the articles of incorporation providing for an exchange of the class A and B common stock for new voting common stock, to be created, in the ratio of five shares of new voting common stock for each share of class A and class B common stock now held.

VIRGINIA UTILITY AUTHORIZED TO INCREASE STOCK.—The Virginia Electric & Power Company has been granted an amendment to its charter by the State Corporation Commission of Virginia whereby its common capital stock may be increased from 480,000 shares to 580,000 shares. Officials of the company said that the proceeds of this stock would not be placed on public sale, but would be used for necessary improvements and expansion of service.

ENGINEERS PUBLIC SERVICE TO INCREASE STOCKS.—Stockholders of the Engineers Public Service Corporation will vote May 20 on increasing the authorized common stock (no-par value) from 3,000,000 shares to 4,000,000 shares and the authorized preferred stock (no-par value) from 700,000 shares to 1,000,000 shares.

UTILITIES POWER & LIGHT CORPORATION TO ISSUE FIVE MILLION SHARES.—A special meeting of stockholders of the Utilities Power & Light Corporation will be held May 22 in Richmond, Va., for the purpose of considering an amendment to the charter, creating an issue of 5,000,000 shares of common stock without par value in addition to present authorized stocks.

# New Offerings in April Meager

DURING the month of April new offerings by the electric light and power companies of the country totaled $29,865,000, the smallest sum recorded for any month since July, 1928, when the total of $4,345,000 was raised. Last month new issues of electric service companies totaled $174,270,500 and in April of 1928 $279,535,000. The largest individual issue was offered by the Carolina Power & Light Company in the form of first and refunding mortgage gold bonds, priced at 99, a piece of financing involving a total of $8,000,000. The average yield on the issues reached the 5.72 per cent mark.

*New Security Issues of Electric Service Companies in April*

| Name of Company | Amount of Issue (Par Value) | Period Years | Class | Purpose | Interest Rate | Price | Per Cent Yield |
|---|---|---|---|---|---|---|---|
| Massachusetts Utilities Associates | $4,000,000 | 20 | Sinking fund gold debentures, series A | To retire a portion of convertible participating pref. shares and for the repayment of bank loans | 5 | 94 | 5.50 |
| Commonwealth Utilities Corp. | 1,500,000 | .. | Cumulative preferred stock, series C | To raise funds to pay for a majority interest of the common and preferred stocks of the Arizona Power Company and for other corporate purposes | 6½ | 100 | 6.50 |
| Peoples Light & Power Corp. | 3,360,000 | .. | Cumulative preferred stock (with class A common stock purchase privilege) | To retire obligations incurred in connection with the acquisition of properties now owned by subsidiaries and for other corporate purposes | 6 | 96 | 6.25 |
| Carolina Power & Light Co. | 8,000,000 | 27 | First and refunding mortgage gold bonds | To reimburse for expenditures made for additions to property and for other corporate purposes | 5 | 99 | 5.06 |
| United Power, Gas & Water Corp. | 3,800,000 | .. | Common stock | To acquire additional securities | .. | 38 | .... |
| | 2,205,000 | .. | Preferred stock | | | 49 | .... |
| State Line Generating Co. | 7,000,000 | 2 | Notes | Construction | 5½ | 98¾ | 6.18 |
| Total | $29,865,000 | | | Rights $5,191,693 | | | |
| Total amount actually realized | 29,323,100 | | | Total financing for April $34,514,793 | | | |

# Business News and Market Conditions

## Barcelona Exhibition Attracts Electrical Interests

ELECTRICAL interests will be widely represented at the Barcelona International Exhibition, which opens May 15 under the auspices of the King of Spain and Spain's leading industrialists.

American manufacturers of electrical tools, equipment and supplies have reserved 250 sq.m. of space in the palaces of Construction, Chemical Industries and Motion Pictures in the great industrial zone of the exhibition, according to M. Ventura, official delegate to this country from Barcelona.

Included among exhibitors are the Arrow-Hart & Hegeman Electric Company, Hartford, Conn., manufacturer of electrical wiring devices and switches; Black & Decker Manufacturing Company, Towson, Md., manufacturer of portable electric tools; Chicago Pneumatic Tool Company, New York; Foldex Electric Heating Company, Detroit, Mich., manufacturer of electric heaters; Gilby Wire Company, Newark, N. J.; Hisey-Wolf Machine Company, Cincinnati, Ohio, manufacturer of electric drills and grinders; Jewell Electrical Instrument Company, Chicago, Ill., manufacturer of electrical measuring instruments; Lightolier Company of New York, lighting equipment and lamps; Shepherd Electric Crane & Hoist Company, New York; Wellington J. Smith Company, Cleveland, maker of electric incubators and brooders, and the Wiremold Company, Hartford, Conn., manufacturer of electrical wiring products.

Six hundred million dollars has been appropriated by the government of Spain for public works development during the next ten years. Construction work is going forward on bridges, tunnels, highways, naval bases and industrial buildings. Trains are being speeded up and electrified and American equipment—power shovels, internal combustion engines, electric tools, generators and motors—is being bought on a large scale for the excavation and other work.

Two new power plants have just been completed with a development capacity of more than 3,000,000 hp. and plans approved by the government for the electrification of Spain on a large scale.

The Spanish market for electrical home equipment has not been greatly exploited. Electric fans, irons and heaters are extensively used in the better homes, but washing and ironing machines, electric ranges and refrigerators are virtually unknown.

## Industrial Heat Contest

The number of submittals received in the N.E.M.A.-N.E.L.A. Slogan Contest indicates a general interest in the subject of industrial electric heat on the part of many industries, according to an announcement from the National Electrical Manufacturers' Association. This contest, which closes May 30, is sponsored by the manufacturers and the National Electric Light Association to obtain a slogan descriptive of electric heat in industry. Seven prizes, totaling $500, will be awarded.

Further details of the contest may be obtained by writing to N.E.M.A., 420 Lexington Avenue, New York City.

## U. S. Steel Orders Advanced in March

Unfilled orders of the United States Steel Corporation increased 266,377 tons in March, bringing the total tonnage on the books up to 4,410,718 tons at the end of the month. This compares with 4,144,341 tons on Feb. 28. The shipments in March, it is understood, were between 1,450,000 and 1,500,000 tons, against about 1,250,000 tons in February and about 1,200,000 tons in January. It was calculated that new business booked by the corporation last month was around 1,750,000 tons.

The following table shows unfilled orders at the end of January, February and March beginning with 1926.

| | 1929 | 1928 | 1927 | 1926 |
|---|---|---|---|---|
| Jan.... | 4,109,487 | 4,275,947 | 3,800,177 | 4,882,739 |
| Feb.... | 4,144,341 | 4,398,189 | 3,597,199 | 4,616,822 |
| Mar... | 4,410,718 | 4,335,206 | 3,553,140 | 4,379,935 |

Railroad buying has figured largely in the recent increase in the Steel Corporation's business. A substantial improvement also has taken place in the demand for structural steel.

## Metal Markets Still Inactive

The situation in the metal markets is entirely unchanged from last week, buyers in general taking little interest and sellers quoting unchanged prices and being content to wait until demand manifests itself rather than force metal on an unwilling market by cutting prices.

Copper continues at 18 cents, delivered at usual Connecticut points, but the volume sold is only nominal and has declined for the last three weeks. The large producers are not selling anything at all, such business as there is going to the custom smelters. The latter are probably not selling their local intake, but there are no indications that this is worrying them.

NEW YORK METAL MARKET PRICES

| | Apr. 24, 1929 Cents per Pound | May 1, 1929 Cents per Pound |
|---|---|---|
| Copper, electrolytic | 18 | 18 |
| Lead, Am. S. & R. price | 7.00 | 7.00 |
| Antimony | 9.44 | 9.0625 |
| Nickel, ingot | 35 | 35 |
| Zinc, spot | 6.975 | 6.95 |
| Tin, Straits | 44.875 | 43.75 |
| Aluminum, 99 per cent. | 24.30 | 24.30 |

Base copper wire price May 1, 1929, 19¾ cents.

## *Delinquent Electrical Accounts*

(Data Supplied by National Electrical Credit Association)

| Division | March 1928 | March 1929 | Per Cent Increase or Decrease | Three Months 1928 | Three Months 1929 | Per Cent Increase or Decrease |
|---|---|---|---|---|---|---|
| New York | 368 | 268 | —27.1 | 929 | 683 | —26.5 |
| Middle and Southern Atlantic | 195 | 176 | — 9.7 | 537 | 441 | —17.9 |
| New England | 98 | 167 | +70.4 | 362 | 458 | +30.1 |
| Pacific Coast | 12 | 12 | None | 29 | 40 | +38 |
| Central | 1,096 | 740 | —32.4 | 2,690 | 1,934 | —28.1 |
| Total | 1,769 | 1,383 | —23 | 4,537 | 3,556 | —21.6 |

TOTAL AMOUNTS REPORTED

| | March 1928 | March 1929 | Per Cent Increase or Decrease | Three Months 1928 | Three Months 1929 | Per Cent Increase or Decrease |
|---|---|---|---|---|---|---|
| New York | $48,397 | $64,073 | + 32.3 | $137,007 | $134,242 | — 2 |
| Middle and Southern Atlantic | 27,186 | 24,576 | — 9.6 | 72,609 | 62,756 | — 13.5 |
| New England | 11,716 | 23,468 | +100.3 | 42,438 | 61,851 | + 45.7 |
| Pacific Coast | 1,736 | 1,106 | — 36.3 | 4,856 | 10,844 | +123.3 |
| Central | 124,008 | 85,779 | — 22.6 | 325,321 | 233,633 | — 28.2 |
| Total | $213,043 | $209,002 | — 1.9 | $582,231 | $503,326 | — 13.6 |

AVERAGE AMOUNTS

| | March 1928 | March 1929 | Three Months 1928 | Three Months 1929 |
|---|---|---|---|---|
| New York | $131 | $239 | $450 | $578 |
| Middle and Southern Atlantic | 139 | 139 | 402 | 428 |
| New England | 119 | 140 | 361 | 390 |
| Pacific Coast | 144 | 92 | 517 | 777 |
| Central | 113 | 129 | 365 | 359 |

# Market Conditions

EVIDENCE ACCUMULATES that construction and replacement programs in the power industry will continue to be heavy for some time to come. Substation and auxiliary equipment are moving in substantial volume, throughout the eastern part of the country especially. Industrial and control equipment are active in New England.

——FARTHER WEST THE VOLUME OF EQUIPMENT BUSINESS is satisfactory, but not by any means exceptional. The St. Louis area reports sales at least 10 per cent over last year's volume at this time.

——BOTH INDUSTRIAL AND POWER COMPANY BUSINESS is exceedingly active on the Pacific Coast. The week's outstanding order is Pacific Gas & Electric Company's order for turbines and accessories totaling $1,500,000.

## *Southeast Business Confined to Routine Orders*

Little change is to be noted in the activities of the Southeast from those reported last week. The general volume is satisfactory, but there were few individual orders of a size worthy of comment. A Carolina power company ordered control cable amounting to $25,000 for a steam station installation, while a Georgia company ordered $20,000 worth of lightning arresters. Inquiries have been made by a Georgia company for quotations on 250,000 lb. of bare and weatherproof copper, while a Florida company is asking for bids on varnished lead-covered cable which will approximate $30,000. A switching equipment order placed in Georgia amounted to $6,900, while Florida came through with a $4,000 distribution and a $2,500 small power transformer order. Some other central-station orders were for $4,200 in racks, $4,000 in wire and cable, $3,300 in creosoted pine poles and appliances costing $2,500. Central-station merchandising activities continue to hold up the volume of appliance sales. A Georgia company in a recently completed five weeks' campaign sold 915 electric ranges and 235 electric water heaters and obtained an order for 124 electric refrigerators for an apartment house installation. A rayon plant in North Carolina ordered $7,000 worth of small power transformers, $7,000 in "whiteway" equipment for the mill village and a lighting panelboard costing $6,000. Such orders as are coming from contractors are being placed by the larger firms and the past week witnessed some interesting orders from this class of purchaser, including a $4,000 lighting panel for a theater, $3,700 in lighting fixtures for a hospital and $2,000 in fans for a small hotel. Construction projects are as follows:

The Monongahela-West Penn Public Service Company, Fairmont, W. Va., plans extensions in transmission lines at Webster Springs, W. Va., and vicinity. The Inland Waterways Company, Louisville, Ky., plans a terminal plant to cost $170,000. Charles H. Stoll, Erwin, Tenn., and associates plan a hydro-electric power plant on the Nolichucky River, to cost $1,000,000, with transmission lines. The Union Coca-Cola Bottling Company, Union, S. C., plans a plant to cost $70,000. The Atlanta Aircraft Corporation, Atlanta, Ga., plans a plant to cost $250,000. The Florida Turpentine Company, Live Oak, Fla., plans a plant to cost $200,000.

## *Central-Station Business Leads in Eastern District*

Power company purchases are giving buoyancy to the market in the Eastern district. Although commitments are restricted to current requirements, the volume of business is satisfactory due to the growth in active accounts. The demand for substation and auxiliary equipment continues as a feature of the situation and there is a healthy tone to orders, with inquiries maturing at an increasing rate. A metropolitan utility company has placed a contract with a New York manufacturer for transformers and accessory apparatus to cost $100,000. A power company in south Jersey has purchased transformers and lightning arresters for a new project, costing $50,000. A northern New York central station has contracted for a transformer unit to cost $20,000, while a power company in Ohio has given an award to the same manufacturer for transformers to cost $35,000. Switching equipment is moving satisfactorily in an expanding market and one of the largest single sales for the week covers a commitment from a railroad in New York totaling $250,000.

Transactions in prime movers are inclined to be quiet at the present time, but early future commitments look promising both for turbo-generators and waterwheel units. A Middle West manufacturer is furnishing a turbine installation for a rayon mill in North Carolina, while another maker in the same district has secured an order for a municipal power station in Texas. Oil circuit breakers are in good call, with inquiries tending to higher levels. A central station in North Carolina has contracted with a New York manufacturer for a quantity of such apparatus to cost $35,000. Industrial business shows a little decline and more conservative purchasing is current. Small orders are dominating the market. The electrification of coal breakers in the anthracite fields of Pennsylvania is opening up some satisfactory transactions for immediate deliveries. Motor sales are fair and units up to 10 hp. are securing the bulk of attention. A New York manufacturer will furnish a motor-generator set for a metal refining plant in Texas, to cost $100,000. Another metal producer in western Pennsylvania has contracted with the same maker for a quantity of equipment for a branch plant in northern New York totaling $25,000. Construction projects are as follows:

The Quartermaster Supply Officer, United States Army, Brooklyn, N. Y., will receive bids until May 17 for three 500-kva. power transformers (Circular 205). The Board of Education, Newark, N. J., will receive bids until May 8 for electrical supplies, electric time clocks, electric lamps and other equipment. The Magnetic Pigment Company, Trenton, N. J., will build an addition to cost $90,000. The Thermoid Rubber Company, Trenton, N. J., will build an addition to cost $75,000. Swarthmore College, Swarthmore, Pa., contemplates an addition to its power plant to cost $100,000. The Hershey Industrial School for Boys, Hershey, Pa., will build an addition to cost $200,000. The Glenside Business Men's Association, Glenside, Pa., plans an ornamental lighting system. The American Telephone & Telegraph Company, New York, contemplates a relay and substation at Ligonier, Pa. The Sharon Tube Company, Sharon, Pa., will establish a steel tubing mill to cost $100,000. The Arundel Corporation, Baltimore, Md., will make expansions at its sand and gravel plants to cost $750,000. Easton, Md., plans a municipal electric light and power plant to cost $35,000. The Continental Can Company, New York, will make extensions at its Baltimore, Md., plant to cost $100,000. The Post Office Department, Washington, will receive bids until May 8 for a 3-kw. motor-generator set, until May 10 for three 1-hp. motors, until May 13 for two motor-generator sets and until May 13 for eight motors. The General Purchasing Officer, Panama Canal, Washington, will receive bids until May 20 for electric motors, magnet wire, electric fixtures, reflectors and other electrical apparatus (Panama Schedule 1960). The War Department, Washington, plans a power plant at Wright Field, Dayton, Ohio, to cost $300,000.

## *Industrial Equipment Sales Gain in New England*

Sales of industrial equipment are brisk and motor and control equipment orders are draining manufacturers' stocks in the New England district. Scheduled material orders are steady and quotations are asked for line equipment for numerous extensions. Small motor orders reached over $65,000, according to one manufacturer, and small switches and control apparatus orders totaled $4,300 for the past week. Watt-hour meters, regulators and general station equipment orders are steady the sales for the past week recorded by one manufacturer reaching over $78,000 on local orders. Heavy equipment is attracting interest and the closure of several interesting orders for heavy power

equipment is expected soon. Both paper mills and textile plants are resuming activity in the electrical market. Electric heated enameling furnaces are reported to have received consideration and promise to gain headway in sales soon and a number of pot furnace orders were placed recently. An arc-welding unit is being considered by a well-known technical institute. Construction projects are as follows:

The Quartermaster, United States Army, Fort Williams, Me., will receive bids until May 8 for two generator plants, two Diesel marine engines, etc. (Circular 41). The Edison Electric Illuminating Company, Boston, contemplates a transmission line from Saxonville to Maynard and Acton, Mass., to cost $100,000, and power substations, etc., to cost $200,000. The Ceco Manufacturing Company, Providence, R. I., plans a radio equipment manufacturing plant to cost $100,000.

## *Industrial Motors in Demand in St. Louis Area*

The demand for industrial types of motors and transformers is holding up in spite of the rise in prices in the St. Louis district. The volume of sales for the past four months has been at least 10 per cent above the same period last year. The following contracts have been reported closed: An order for 32 motors for hoisting and general service costing $35,000 for a smelting company, five 150-hp. motors costing $8,000, a lot of arc welders for a car company in Illinois costing $7,000 and eight electric elevators to replace old type machines in a large office building, the total cost of changes being about $250,000, the electrical equipment alone costing $35,000. Construction projects are as follows:

The Union Electric Light & Power Company, St. Louis, plans a hydro-electric power plant on the Osage River, near Bagnell, Mo., to cost $25,000,000. The International Shoe Company, St. Louis, plans an addition to its mill at Hannibal, Mo., to cost $60,000. The Moerschel Products Company, Jefferson City, Mo., plans an electric-operated ice-manufacturing plant to cost $100,000. The North Kansas City Alfalfa Mills, North Kansas City, Mo., plans an alfalfa feed mill to cost $90,000. The International Harvester Company, Chicago, will build a factory branch and distributing plant at Springfield, Mo., to cost $100,000. The Alexander Aircraft Company, Colorado Springs, Colo., plans airplane assembling plants at St. Louis and other points, to cost $150,000. The Commercial Concrete & Material Company, St. Louis, plans a plant to cost $140,000. The Oklahoma Gas & Electric Company, Oklahoma City, Okla., plans a power plant at Ponca City, Okla., to cost $200,000. The Central Power & Light Company, San Antonio, Tex., will build a transmission line to Bay City, El Maton, and Markham, Tex., to cost $90,000. The Texas Aero Corporation, Temple, Tex., plans an aircraft manufacturing plant at Dallas, Tex., to cost $70,000. Ennis, Tex., plans an ornamental lighting system. The Tidal Refining Company, Houston, Tex., plans an oil refinery to cost $2,500,000. The Texas Utilities Company, Lubbock, Tex., plans an ornamental lighting system at Tahoka, Tex., Natchitoches, La., plans a floodlighting system to cost $50,000.

## *Middle West Utilities Proceed With Construction Programs*

Business in the Middle West continues on a generally satisfactory basis. The major activities, steel, automotive and railroad industries, are in an excellent position. Car loadings indicate a general increase in the movement of commodities, with considerable diversity of products. Industrial activity, to all appearances, is maintaining the pace set earlier in the year and general conditions are favorable. The utility companies continue with their construction and rehabilitation plans, contributing in a great extent to the general prosperous condition. Some interesting orders that have been placed include one for 600 35-ft. AA, 1,000 40-ft. AA, 1,000 45-ft. AA, 200 45-ft. A Western red cedar poles, two Vorticose dust collectors complete with appurtenances, one set of traveling screens complete with appurtenances, four 2,000-amp., 1,500-volt direct-current, high-speed air circuit breakers, six 7,500-volt, 400-amp., single-pole, single-throw, solenoid-operated oil circuit breakers and several construction orders aggregating $60,000. Jobbers' sales are normal and several large inquiries for electrical wiring materials are pending, with the usual amount of new inquiries coming in. Construction projects are as follows:

The Hamilton & Sons Canning Company, New London, Wis., plans an addition to cost $100,000. The Bay City Shovels, Inc., Bay City, Mich., will build an addition to cost $65,000. The Wisconsin Michigan Power Company, Appleton, Wis., plans a power substation at Caspian, Mich., to cost $135,000. Flint, Mich., plans a power plant at the proposed McKinley school, entire project to cost $400,000. The Consumers Power Company, Jackson, Mich., plans a hydro-electric power plant on the Muskegon River at Oxbow, Mich., to cost $1,000,000, and will extend transmission lines. The Gypsum Canning Company, Port Clinton, Ohio, will build a plant at Northport, Mich., to cost $65,000. The C. N. Fries Company, Chicago, will build a lacquer manufacturing plant to cost $75,000. The Cornstalk Products Company, Danville, Ill., contemplates additions in its pulp mill to cost $200,000. The Whiting Corporation, Harvey, Ill., plans an addition to its machinery plant to cost $100,000. The Vredenburgh Lumber Company, Springfield, Ill., contemplates an addition to cost $80,000. The Allison Engineering Company, Indianapolis, Ind., plans expansions in its gear and engine plant to cost $500,000. The Marmon Motor Car Company, Indianapolis, Ind., plans an addition to cost $250,000. The Pennsylvania Railroad Company, Indianapolis, Ind., will build additions to its locomotive shops and power plant to cost $500,000. The Real Silk Hosiery Mills, Indianapolis, Ind., will build an addition to cost $1,000,000. The C. A. Dunham Company, Chicago, plans a heating equipment manufacturing plant at Michigan City, Ind., to cost $600,000. The Kennedy Car Liner & Bag Company, Shelbyville, Ind., will build an addition to its paper mill to cost $100,000. Purdue University, West Lafayette, Ind., will receive bids until May 14 for mechanical and chemical engineering buildings to cost $475,000. The Cleveland Electric Illuminating Company, Cleveland, will build a power plant at Ashtabula, Ohio, to cost $1,000,000. The Crosley Radio Corporation, Cincinnati, Ohio, will make expansions and will build an addition to cost $500,000. The Contracting Officer, Material Division, Air Corps, Wright Field, Dayton, Ohio, will receive bids until May 13 for one motor-generator set, (Circular 371). The Empire Steel Corporation, Mansfield, Ohio, will make extensions in its mill at Niles, Ohio, to cost $100,000. Orrville, Ohio, will build an addition to its municipal power plant to cost $50,000. Tippecanoe City, Ohio, plans an addition to its municipal power plant and waterworks to cost $100,000. The Youngstown Sheet & Tube Company, Youngstown, Ohio, will make expansions at its mills to cost $10,000,000. Broken Bow, Neb., plans a municipal power plant to cost $55,000. The Iowa Southern Utilities Company, Ottumwa, will build an addition to its power plant to cost $275,000. Iowa Public Service Company, Sioux City, will build a power plant at Spirit Lake, Iowa, to cost $35,000.

## *Big Turbine Order Features Pacific Business*

The week's outstanding order on the Pacific Coast covers two General Electric turbines of 70,000 hp. each for the Pacific Gas & Electric Company's San Francisco steam plant, the total value with accessories being $1,500,000. One is to be delivered in the fall of 1930 and the other early in 1931 for midyear installation. To the Crocker-Wheeler Electric Manufacturing Company were awarded the condensers. The General Electric Company also was awarded the order for a group of 60 automatic voltage regulators valued at $100,000. Stock sizes of motors and transformers are moving slowly and the total is considerably below last year's demand. Power company purchasing includes 150,000 lb. of No. 4 and No. 6 bare copper wire, 10,000 dead ends and four assorted carloads of sizes 35 to 50 ft. treated poles. Prospective power construction includes an 18,000-acre irrigation district near Truckee, Calif.; a three-mile, 4,000-volt line to the U. S. Naval ammunition depot at Hawthorne, Nev., and a 7,500-hp. Diesel generating plant for the Modesto irrigation district. Street and airport lighting business includes a San Mateo, Calif., award of $11,612, a proposed system for Fallon, Nev., estimated to cost $12,500; a 101-light extension to the Berkeley, Calif., present system, a $50,000 appropriation for lighting and safety signals in San Francisco's municipal airport, lighting extensions in Petaluma, Martinez and San Jose, Calif., and a $40,000 lighting extension in the Potrero, Calif., district.

Central-station buying, which has been heavy for the past few weeks, was exceedingly light last week in the Puget Sound district. Jobbers' sales also were light, involving principally small motors of from 1 to 15 hp. to dealers. One firm reported sales of one 200, one 150 and one 100 hp. machines to three lumber mills and another about $3,000 worth of disconnecting switches, etc., to a local central station. The city of Tacoma bought a carload of insulators and the city of Seattle 50,000 ft. of ⅝-in. guy wire. Bids opened by the city of

Tacoma on April 25 for oil circuit breakers for unit No. 2 of the Lake Cushman hydro-electric project, involving an outlay in excess of $100,000, are still being considered. The Grays Harbor Railway & Light Company, Aberdeen, Wash., is preparing specifications for materials for a 60-mile transmission line extension from Grays Harbor to Willapa Harbor, Wash. The town of Auburn, Wash., on May 21 will open bids for a street lighting system. Construction projects are as follows:

The General Paint Company, San Francisco, contemplates a plant at Los Angeles, to cost $200,000. The Pacific Cotton Seed Products Corporation, Tulare, Calif., plans a mill to cost $60,000. The Pacific Power & Light Company, Portland, Ore., plans a power plant on Wallowa Lake, near Joseph, Ore., to cost $250,000. The Shoshone Electric Light & Power Company, Cody, Wyo., contemplates extensions in its power plant to cost $35,000. The Public Service Company of Colorado, Denver, Colo., contemplates a transmission line to Crook, Colo., to cost $29,000.

# Activities of the Trade

## Delta-Star Expands Facilities Both Here and Abroad

H. W. Young, president of the Delta-Star Electric Company, Chicago, Ill., advises that in line with his policy of expansion the following additions to the manufacturing and distribution facilities have been made:

The Champion Switch Company has been purchased and the Kenova, W. Va., plant will continue manufacturing its present line of equipment in addition to several new designs.

Manufacturing arrangements have been made with the Société D'Installations et de Constructions Electriques et Mécaniques, Boulogue - sur - Seine, to manufacture and distribute Delta-Star equipment in France and its colonies.

An interest has also been acquired in the Monarch Electric, Ltd., St. Johns, Que., which will soon be operated as the Monarch Delta-Star Company. At the Canadian factory will be manufactured a complete line of Delta-Star equipment, in addition to the present switching equipment, switchboards, oil circuit breakers and oil switches. New designs of large capacity oil breakers for voltages up to 132 kv. will be added in a very short time.

Mr. Young states that Delta-Star equipment will be handled by its established sales organization and the Kenova Champion works will be operated as a separate unit with its own sales organization.

The St. Johns factory will handle all business for Canada and the British possessions and the French factory will have its own sales organization.

With this set-up domestic and foreign requirements can be met with an extensive line of air and oil break switching or substation equipment.

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SPLITTING AND WINDING MACHINES FOR ADHESIVE TAPE which, it is claimed, assure against frayed edges and also prevent the rolls from becoming knitted, mashed or sealed together are being manufactured by the Cameron Machine Company, Brooklyn, N. Y. As the web is brought from the saturating machine or mill roll it is cut, edges sealed and wound evenly ply by ply into a number of rolls of any desired width all in one operation. Moreover, the same machine is also used for cutting paper cores on which the required widths of paper are wound. Frayless edge friction tape made on the "camachine" cuts the web of impregnated material on hardened steel rollers by means of the "camachine" pressure cut.

ORNAMENTAL FLOODLIGHTS have been added by the King Luminaire Company, 37 West Jackson Boulevard, Chicago, to its present range of ornamental industrial lighting equipment. In the new equipment the floodlight reflector and lamps are inclosed in a King "Luminaire" ornamental lantern, eliminating the reflectors that have been used in the past, thus serving the dual purpose of a floodlighting lantern plus the ordinary illuminating function.

THE WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY has received an order from the Sun Shipbuilding & Dry Dock Company, Chester, Pa., for the complete electrical equipment for two Diesel electric tankers. The propulsion equipment of each tanker will consist of two Bessemer six-cylinder, four-cycle Diesel engines, each directly connected to a 130-kw., 125-volt main generator of the new Westinghouse fabricated construction.

THE HOOVER COMPANY, North Canton, Ohio, manufacturer of vacuum cleaners, announces the removal of its advertising, engineering and patent departments executive headquarters from the Railway Exchange Building, Chicago, to the new Willoughby Tower Building, Chicago.

THE GENERAL ELECTRIC COMPANY has leased for a long term of years a building containing 135,000 sq.ft. of floor space at 416 West Thirteenth Street, New York City.

THE RAILWAY & INDUSTRIAL ENGINEERING COMPANY, Greensburg, Pa., announces the opening of a district office in Buffalo, N. Y., with headquarters at 877 Ellicott Square Building. Harry G. Johnson, formerly a sales engineer in the Cleveland territory, is manager of the new office.

## General Cable Appointed Copperweld Agency

The General Cable Corporation has announced the consummation of an agency agreement with the Copperweld Steel Company whereby the former is appointed exclusive agent in the United States to draw wire from Copperweld rods and to sell wire so drawn and wire products made therefrom.

The Copperweld Steel Company has recently enlarged its special equipment for the production of Copperweld billets and rods and the General Cable neering, sales and distribution organi- Corporation has, in its several plants, large capacity for the drawing of these rods into wire and for the fabrication of wire products. These complementary facilities, together with the engizations of both companies, will be effective to increased production and distribution of Copperweld wire and wire products, as well as improved service to all users of Copperweld material.

Hereafter all copper-covered steel wire and wire products handled by General Cable Corporation will be produced exclusively from Copperweld material.

Full and complete sales and engineering service on Copperweld wire and wire products is now available through each of the divisions of the General Cable Corporation.

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THE BENJAMIN ELECTRIC MANUFACTURING COMPANY, 120 South Sangamon Street, Chicago, has moved to Des Plaines, Ill.

LANDERS, FRARY & CLARK, New Britain, Conn., manufacturers of electrical appliances, announce a new "Universal" model No. 58 motor-driven brush, ball-bearing electric cleaner.

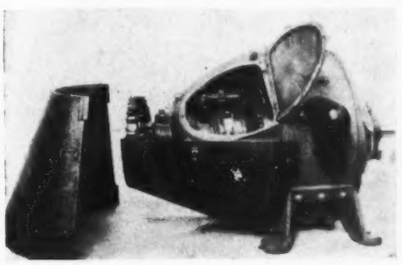
THE IDEAL COMMUTATOR DRESSER COMPANY, Sycamore, Ill., announces that it has purchased the business of the Bowlus Boring Machine Company of Springfield, Ohio, and is now manufacturing the boring machine in its own plant and marketing it. The machine is known as the new improved Ideal "Bowlus" boring machine.

THE PACIFIC ELECTRIC MANUFACTURING COMPANY, 5813 Third Street, San Francisco, has established a branch factory at Gary, Ind. The plant will be in charge of E. S. Kessler, former executive engineer at the San Francisco office. The complete sales and service on all products sold east of the Mississippi River will be handled by eastern headquarters at Gary. The sales will be under the supervision of C. F. Lomont, formerly vice-president and sales manager of the Illinois Electric Porcelain Corporation, Macomb, Ill., as manager of the eastern division. Assisting Mr. Lomont will be G. B. Kirkwood, sales engineer, who for the past three years has been in charge of sales for the territory in the vicinity of Chicago, and J. T. Cavalier, who has been in charge of sales in the St. Louis territory for the past year.

# New Equipment Available

## Fan-Cooled Type SK Motor

A new type SK totally inclosed fan-cooled motor for direct-current applications is announced by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. The standard type SK construction and parts were utilized to the fullest extent in recognition of the general demand for simplicity and interchangeability of parts. All mechanical parts with the exception of the shaft are interchangeable with those used on the present



totally inclosed motor of the same frame size. The essential mounting dimensions of the new type motor are the same as on the standard open type SK motor of the same frame size.

The bracket openings are closed with solid flat inclosing covers and gaskets and the cooling system does not interfere with the effectiveness of the motor inclosure. This type of construction is said to permit the use of steel sleeve bearings and thus the motor is totally inclosed and sealed from dust and fumes.

The commutator end of the motor is further inclosed with a sheet steel cover which has a perforated protective end through which the fan draws the cooling air. The cooling air is directed over the bracket and passes out over the top of the motor, covering approximately three-quarters of the surface.

This motor is applicable to coal-handling equipment and anywhere where the air is full of foreign matter which may be injurious to motor windings.

## Angle-Mounted Locked-Cartridge Expulsion Fuse

A new 7,500-volt, type ED2-76C1 150-amp., outdoor, angle-mounted, locked-cartridge expulsion fuse has been brought out by the Line Material Company, South Milwaukee, Wis. The lower casting affords a pivoted hinge for the cartridge and is so designed as to prevent the square lower terminal on the fuse cartridge from moving away from the contact clips. The cartridge is securely locked in the closed position by means of a positive catch just below the top contact clip. The catch is held by means of a bronze spring and cannot be disengaged except by pulling the ring handle downward. The top cartridge terminal is equipped with a knurled cap and the lower one cast with a guiding fin equipped with knurled contact screw. A small L-shaped projection is fastened to the lower square terminal block on the cartridge for use in connection with the combination lift and pull stick. The contacts are spaced on 12-in. centers and are double spring clip type, with phosphor bronze reinforcing clips, insuring ample and uniformly distributed pressure. The top contact clips are the full floating type, insuring proper alignment at all times. The lower clips are fixed and with the guiding fin on the lower cartridge terminal act to guide the cartridge into the upper contact clips.

The angle mounting holds the cartridge at an angle, causing the flame and gases to be expelled away from the pole. There is less possibility of crossarms being burned with this type of mounting. The angle mounting is of galvanized malleable iron and has an 11,000-volt one-piece insulator cemented at each end which is allowed to set under steam, insuring a perfect bond.

The cartridge can be furnished of "Bakelite" with or without an outer porcelain tube for additional protection from the weather. Fiber tubes can also be furnished, in which case an outer porcelain tube is always provided. All "Bakelite" tubes are provided with a special high-heat-resisting lining which does not readily carbonize.

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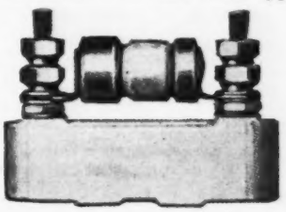
AUTOMATIC LIGHTING EQUIPMENT FOR DARK SCHOOLROOMS. — A small automatic electric device has been developed by research engineers of the General Electric Company to turn on the light in schoolrooms on dark days. The device consists of a small box about the size of an ordinary radio receiving set. At one end is a lens which allows light from the outside to fall upon a photo-electric tube, better known as an "electric eye." This is set for a certain degree of daylight intensity, and whenever the light from outside falls below this mark the electric eye causes a small relay to switch on the electric lights in the room. This is designed to eliminate the ill effects of lack of adequate light which is not always noticed by the teacher.

## Crystal Valve Arresters for Low-Voltage Service

A low-voltage arrester of new design is announced by the Electric Service Supplies Company, Philadelphia. The new arrester has inherent in it all the usual characteristics of the company's high-voltage arrester line. It is designed to fit the standard ARA block, is of the air gap type, with a small column of "crystallite," the material which is responsible for these characteristics, and requires no testing or inspection other than to see that it is in place and intact. The insulating portions of the arrester itself are made from the highest grade of electrical insulation available at the present time—"isolantite."

The arrester is of the valve type and

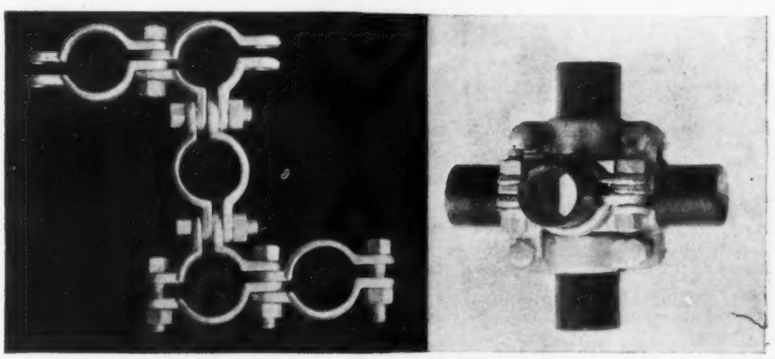


since the valve cut-off voltage is set somewhat in excess of the maximum voltage rating of the arrester no line current follows the lightning discharge to ground. In operation, therefore, the arrester acts simply as a safety valve for excess voltage built up on the line. Since no line current flows it follows that there is no tendency for the discharge electrodes either to burn away or to freeze together, thereby grounding the line..

The arrester has high discharge capacity as it can readily discharge 1,000 amp. from the lightning generator with no ill effects. Due to its high speed of discharge and capacity it therefore offers a high type of protection.

## Pipe Fittings Provide for Various Combinations

A new line of forged steel hot galvanized pipe fittings with but five different parts from which a large number of



combinations can be made is announced by the Delta-Star Electric Company, Chicago. Three of these fittings only are necessary for pipe combinations, the two others making possible many types of floor and brace flanges.

# Electrical Patents

*Announced by U. S. Patent Office*

(Issued April 16, 1929)

1,709,283. ELECTRIC SAFETY DEVICE; E. A. Richmond and E. A. Dix, Quincy, Ill. App. filed Aug. 27, 1924.

1,709,297. PROCESS OF PREPARING MALEIC AND SUCCUNIC ACID FROM FURFURAL BY ELECTROLYSIS; T. Yabuta, Setagaya-Machi, Ebara-Gori, Japan. App. filed March 31, 1926.

1,709,340. ELECTRIC HEATER; P. B. Crocker, Taunton, Mass. App. filed May 15, 1928.

1,709,357. ELECTRIC WIRE TAP; L. Ludwig, Brooklyn, N. Y. App. filed June 9, 1927.

1,709,381. COLLECTOR FOR ELECTRIC ENGINES WITH ROTATING BRUSHES AND STATIONARY COPPER SEGMENTS; M. Urbinati, Rome, Italy. App. filed Aug. 30, 1926.

1,709,415. COMMUTATOR SHORT-CIRCUIT DEVICE; R. W. Swift, Warren, Ohio. App. filed Feb. 4, 1925.

1,709,427. ELECTRICAL CONDENSER; V. Bush, West Medford, Mass. App. filed March 16, 1927.

1,709,431. ELECTRIC-CURRENT TAP AND CONNECTOR FITTING; H. Hertzberg, Brooklyn, N. Y. App. filed June 23, 1926.

1,709,438. ELECTRIC HEATING ELEMENT; F. W. Moffat, Weston, Ont., Can. App. filed Jan. 28, 1928.

1,709,453. SWITCH; A. Alsacker and S. J. Lurie, Chicago, Ill. App. filed Sept 2, 1927.

1,709,474. WELDING ROD; J. B. Hawley, Jr., Minneapolis, Minn. App. filed April 11, 1928.

1,709,477. INSULATOR; W. D. Kyle, Milwaukee, Wis. App. filed Jan. 9, 1922.

1,709,505. ELECTRIC RADIATOR; B. F. P. Vedder, Milwaukee, Wis. App. filed March 5, 1927.

1,709,517. SIGNAL APPARATUS ASSOCIATED WITH ELECTRICALLY-CONTROLLED MACHINERY; A. E. Billingsley, Lehigh-on-Sea, England. App. filed May 4, 1928.

1,709,523. ANODE; F. J. Delavie and H. H. Blouch, Cleveland, Ohio. App. filed Nov. 29, 1927.

1,709,573. METHOD OF AND APPARATUS FOR MEASURING DISTANCE; H. C. Hayes, Annapolis, Md. App. filed Jan. 31, 1922.

1,709,587. ELECTRIC TUBE-WELDING MACHINE; J. F. Lawson, Toronto, Ont., Can. App. filed Jan. 13, 1922.

1,709,601. CONDENSER; R. B. Benjamin, Chicago, Ill. App. filed Feb. 8, 1926.

1,709,606. METHOD OF FORMING CUTTERS; R. O. Catland, Los Angeles, Calif. App. filed April 6, 1928.

1,709,613. REMOTE METERING SYSTEM; E. R. Evans, Pittsburgh, Pa. App. filed Dec. 4, 1924.

1,709,616. REGULATING SYSTEM; A. M. Goodwin, Boston, Mass. App. filed Nov. 6, 1925.

1,709,619. DIRECTION-INDICATOR SWITCH; A. R. P. Johnson, Toronto, Ont., Can. App filed July 25, 1927.

1,709,629. ARC WELDING SYSTEM; J. F. Peters, Edgewood Park, Pa. App. filed Sept 10, 1924.

1,709,642. VOLTAGE-CONTROL SYSTEM; B. Weyl, Berlin, Germany. App. filed Oct. 20, 1927.

1,709,643. TEMPERATURE INDICATOR FOR MOTORS; C. C. Whittaker, Pittsburgh, Pa. App. filed June 11, 1927.

1,709,645. IMMERSION HEATER; J. C. Woodson, Mansfield, Ohio. App. filed Nov. 30, 1927.

1,709,648. CIRCUIT-BREAKER TANK; C. Aalborg, Pittsburgh, Pa. App. filed Nov. 10, 1922.

1,709,656. THERMOSTATIC REGULATOR; E. K. Clark, Mansfield, Ohio. App. filed April 2, 1927.

1,709,664. ELECTRIC-RANGE CONSTRUCTION; G. F. Forshee, Mansfield, Ohio. App. filed Dec. 29, 1925.

1,709,665. TRANSMISSION SYSTEM; R. E. Hellmund, Pittsburgh, Pa. App. filed Dec. 13, 1923.

1,709,667. TAP-CHANGING SYSTEM; L. H. Hill, Collingswood, N. J. App. filed July 14, 1928.

1,709,668. INCLOSED SWITCH; O. S. Jennings, Mansfield, Ohio. App. filed April 22, 1927.

1,709,673; REGULATOR; R. T. Kintzing, Wilkinsburg, Pa. App. filed July 19, 1924.

1,709,674. SPEED INDICATOR; L. Kuhl, Berlin-Charlottenburg, Germany. App. filed Jan. 28, 1926.

1,709,681. THERMAL RELAY; A. J. Mottlau, Pittsburgh, Pa. App. filed July 27, 1926.

1,709,687. REGULATOR SYSTEM; N. Schachtmeyer, Berlin, and W. de Vries, Berlin-Charlottenburg, Germany. App. filed April 23, 1926.

1,709,689. REGULATOR SYSTEM; S. A. Staege, Pittsburgh, Pa. App. filed Oct. 10, 1925.

1,709,695. INDUCTION REGULATOR; L. G. Tubbs, Pittsburgh, Pa. App. filed Dec. 13, 1927.

1,709,697. HIGH-POTENTIAL ARCING DEVICE; N. A. Wahlberg, Wilkinsburg, Pa. App. filed Sept. 23, 1922.

1,709,706. SPEED-REGULATOR SYSTEM; C. A. Boddie, Wilkinsburg, Pa. App. filed Sept. 8, 1924.

1,709,716. WELDING CLAMP; J. B. Fielder, Dansville, N. Y. App. filed Sept. 27, 1927.

1,709,724. TRANSFORMER-TAP-CHANGING SYSTEM; L. H. Hill, Collingswood, N. J. App. filed July 21, 1928.

1,709,725. MOTOR-STARTING SWITCH; H. D. James, Edgewood, and C. H. Hodkins, Pittsburgh, Pa. App. filed Oct. 16, 1922.

1,709,757. REGULATING APPARATUS; L. H. Von Ohlsen, New Haven, Conn. App. filed May 28, 1926.

1,709,759. PROCESS OF PRODUCING ALUMINUM; J. Weber, Neuhausen, and H. Hauser, Wilchingen, Switzerland. App. filed June 3, 1926.

1,709,773. METER STRUCTURE; A. Callsen, Nuremberg, Germany. App. filed Jan. 6, 1927.

1,709,775. ELECTRIC SWITCH; J. C. Clinton, Chillicothe, Ohio. App. filed July 20, 1927.

1,709,780. SWITCH GEAR; D. R. Davies, Didsbury, England. App. filed Nov. 22, 1926.

1,709,785. ELEVATOR-SIGNALING SYSTEM; R. H. Gaylord, Los Angeles, Calif. App. filed Jan. 13, 1927.

1,709,786. CONSTANT-CURRENT TRANSFORMER; J. B. Gibbs, Sharon, Pa. App. filed Sept. 16, 1926.

1,709,801. MANUFACTURE OF THIN METALLIC FOILS; C. Müller, Charlottenburg, near Berlin, Germany. App. filed March 6, 1925.

1,709,803. ELECTRICAL MEASURING INSTRUMENT; C. Oman, Swissvale, Pa. App. filed June 23, 1925.

1,709,808. ELECTRIC HOT-AIR FURNACE; J. Quern, Brooklyn, N. Y. App. filed Feb. 25, 1928.

1,709,813. APPARATUS FOR IONIZATION AND CATALYTIC TREATMENT OF MATTER; I. W. Henry, Greenwich, Conn. App. filed Jan. 15, 1927.

1,709,814. APPARATUS FOR AND METHOD OF IONIZATION AND HYDROGENATION OF HYDROCARBON STARTING MATERIAL, VAPOR AND OIL; I. W. Henry, Greenwich, Conn. App. filed Aug. 4, 1927.

(Issued April 23, 1929)

1,709,825. CONNECTER FITTING FOR INSULATORS; A. O. Austin, near Barberton, Ohio. App. filed May 27, 1927.

1,709,826. MEANS FOR DIVERTING ENERGY FROM HIGH-POTENTIAL CONDUCTORS; A. O. Austin, Near Barberton, Ohio. App. filed Jan. 21, 1928.

1,709,830. MANUFACTURE OF ELECTRICAL RECTIFIERS; D. G. Ackerly, Wilkinsburg, Pa. App. filed Aug. 26, 1926.

1,709,846. METHOD FOR LOAD DIVISION IN ELECTRIC-POWER GENERATION; F. W. Gay, Newark, N. J. App. filed May 31, 1928.

1,709,851. ELECTRIC-CURRENT-MEASURING INSTRUMENT; M. J. Huggins, Upper Saddle River, N. J. App. filed Feb. 2, 1924.

1,709,858. LUMINESCENT TUBE; P. F. J. Lebrun, Paris, France. App. filed Aug. 26, 1927.

1,709,924. ELECTRIC-CURRENT CONTROL; E. B. Thurston, Toledo, Ohio. App. filed June 27, 1919.

1,709,935. STARTING DEVICE FOR ELECTRIC MOTORS; F. Diehl, Elizabeth, N. J. App. filed July 21, 1923.

1,709,944. THERMOSTAT; H. R. Loranger, Hillsdale, Mich. App. filed June 2, 1924.

1,709,947. ELECTRIC-SWITCH APPARATUS; F. Prantl, Wettingen, Switzerland. App. filed Aug. 25, 1926.

1,709,951. LIGHT SCREEN; E. E. Richardson, Maumee, Ohio. App. filed Nov. 19, 1927.

1,709,962. ELEVATOR-CONTROL SYSTEM; E. B. Thurston, Toledo, Ohio. App. filed May 8, 1922.

1,709,973. AMMETER; D. V. Fallon, Detroit, Mich. App. filed Oct. 13, 1927.

1,709,996. MAGNETO IGNITION MACHINE; A. G. L. Neighbor, Brighton, Victoria, Australia. App. filed April 2, 1926.

1,710,005. FLOAT-OPERATED SNAP-OVER SWITCH; L. M. Persons, Chicago, Ill. App. filed May 31, 1924.

Information on foreign patents can be obtained through the nearest district office of the Bureau of Foreign and Domestic Commerce, Department of Commerce.

# New Trade Literature

LIGHTNING ARRESTERS. — Bulletin No. 261 issued by the Electric Service Supplies Company, Seventeenth and Cambria Streets, Philadelphia, covers its complete line of lightning arresters and lightning protective apparatus, including the "Keystone" crystal valve lightning arresters, the "Garton-Daniels" lightning arresters, the "Keystone" and "Protex" radio lightning arresters, ground fittings and the "Keystone" disconnecting switches and choke coils. A trade discount sheet for use with the bulletin also is included.

TRANSFORMER OIL.—The Wagner Electric Corporation, 6400 Plymouth Avenue, St. Louis, has issued bulletin No. 162 on Wagner transformer oil. The bulletin contains discussions on the purposes of transformer oil, its properties, methods of testing and precautions when handling and storing.

GRAPHIC INSTRUMENTS.—The Esterline-Angus Company, Indianapolis, Ind., is distributing bulletin No. 329 in which it describes the use of Esterline-Angus graphic instruments by power producers and power users in the elimination of the evils of low power factor.

OIL SEPARATOR.—The Griscom-Russell Company, 285 Madison Avenue, New York City, has issued Form No. 453, covering the "Bundy" oil separator for the removal of oil from exhaust steam, gasoline from compressed natural or casing-head gas, etc. The leaflet describes the construction and the application of the separators and includes a complete table of the arrangements, sizes and dimensions in which they are furnished.

UPRIGHTS.—The Revolvator Company, 336 Garfield Avenue, Jersey City, N. J., is distributing bulletin No. 83-I, describing and illustrating the "Zee-Bar" uprights.

SPROCKET WHEELS.—Book No. 1167 issued by the Link-Belt Company, 910 South Michigan Avenue, Chicago, contains detailed specifications of the 15,000 sprocket wheels that the company now carries in stock.

# Foreign Trade Opportunities

**Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:**

Purchase or agency is desired in Berlin, Germany (No. 38,017), for electric advertising signs.

An agency is desired in Frankfort, Germany (No. 38,086), for electric advertising signs.

An agency is desired in Saloniki, Greece (No. 38,078) for storage batteries.

Purchase is desired in Copenhagen, Denmark (No. 38,059), of composition battery boxes.

An agency is desired in Bombay, India (No. 38,084), for automobile electric bulbs.

Purchase is desired in Bombay, India (No. 38,082), of ebonite and fiber sheets and rods for electric installations, varnished insulating cambric and electric wiring supplies and another (No. 38,077), of varnished insulating cambric.

Purchase is desired in Gananoque, Canada (No. 38,060), of fire alarm apparatus.

Purchase is desired in London, England (No. 38,080) of flasher buttons and sockets for bayonet and Edison screw sockets.

Purchase and agency are desired in Bilbao, Spain (No. 38,078), for electric steel-tempering furnaces.

Purchase is desired in Turin, Italy (No. 38,074), of household electric appliances.

Purchase and agency are desired in Alexandria, Egypt (No. 38,081), for electric lighting fixtures and electric refrigerators.

An agency is desired in Winnipeg, Canada (No. 38,083), for electric motors.

An agency is desired in Berlin, Germany (No. 38,087), for refrigerator units for household refrigerators.

Purchase and agency are desired in Karlsruhe, Germany (No. 37,996), for portable electric tools.

# Business Facts for Electrical Men

**Selected Statistics Presented Graphically for the Use of All Interested in Analyzing the Trend of the Electrical Business**

## Concentrating the Power

STEAM TURBINES averaged four times as large in 1927 as in 1907; their aggregate rating increased thirty-fold. Hydraulic turbines are five times as powerful as they were two decades ago, and comprise nearly eight times the horsepower. Steam engines have been more and more replaced by other prime movers since 1912; the process was particularly rapid in the last five years of the period under review; the replacement was most marked in the smaller sizes.

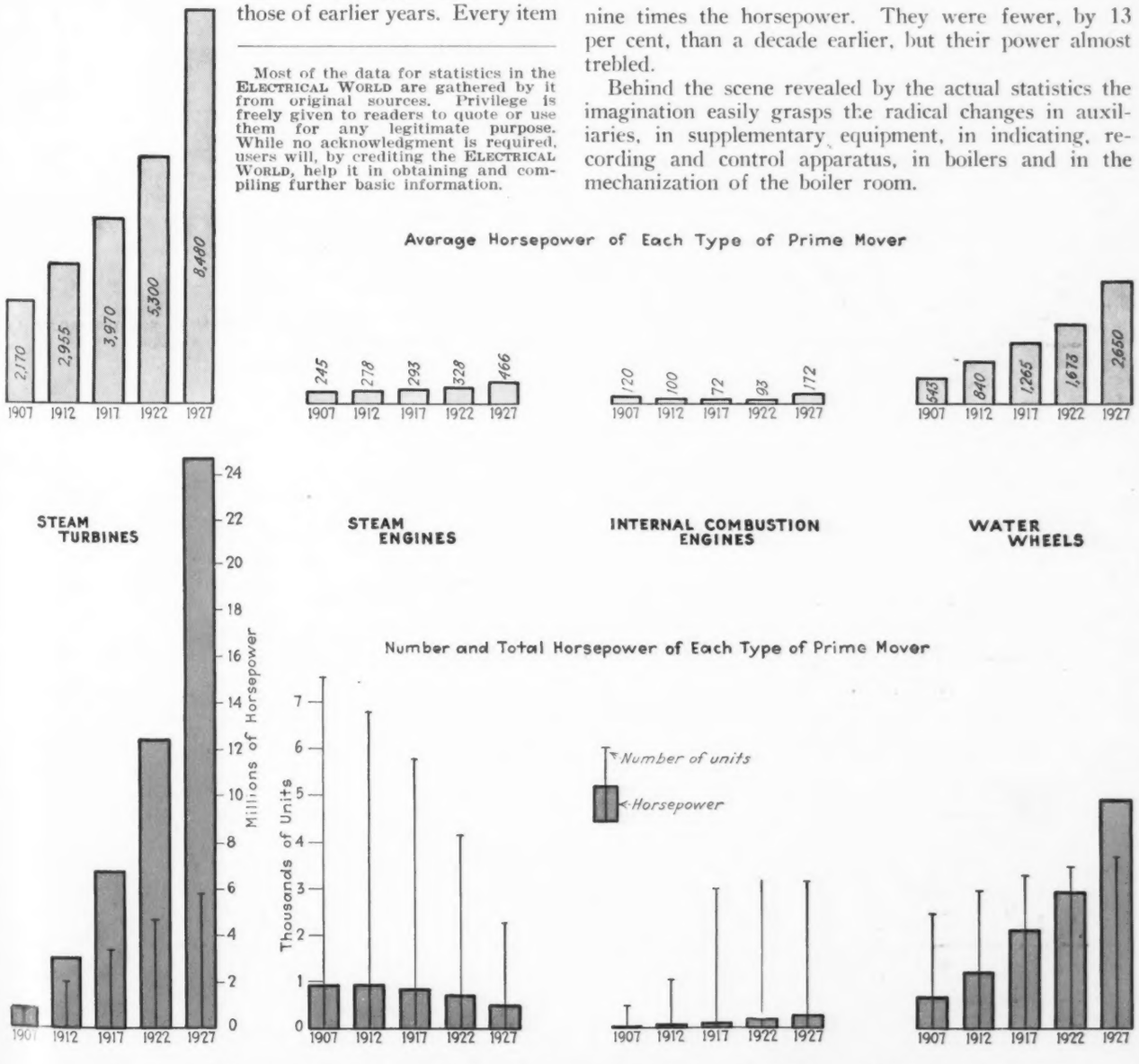
These changes appear from a comparison of the results of the 1927 census with those of earlier years. Every item reflects the trend toward larger plants, larger units and the gradual elimination of the older and smaller installations. The number of machines in 1927 exceeded that of 1907 by less than 10 per cent, though they had almost nine times the horsepower. They were fewer, by 13 per cent, than a decade earlier, but their power almost trebled.

Behind the scene revealed by the actual statistics the imagination easily grasps the radical changes in auxiliaries, in supplementary equipment, in indicating, recording and control apparatus, in boilers and in the mechanization of the boiler room.

Total Prime Movers

| Year | Number | Horsepower | Average Hp. |
|---|---|---|---|
| 1907 | 10,998 | 4,098,188 | 373 |
| 1912 | 11,902 | 7,530,044 | 632 |
| 1917 | 13,795 | 12,936,755 | 937 |
| 1922 | 13,242 | 19,850,860 | 1,500 |
| 1927 | 12,007 | 35,622,593 | 2,970 |

Most of the data for statistics in the ELECTRICAL WORLD are gathered by it from original sources. Privilege is freely given to readers to quote or use them for any legitimate purpose. While no acknowledgment is required, users will, by crediting the ELECTRICAL WORLD, help it in obtaining and compiling further basic information.




*Prime Movers in Central Stations in the United States, 1907 to 1927*

# Continued High Operations in the West

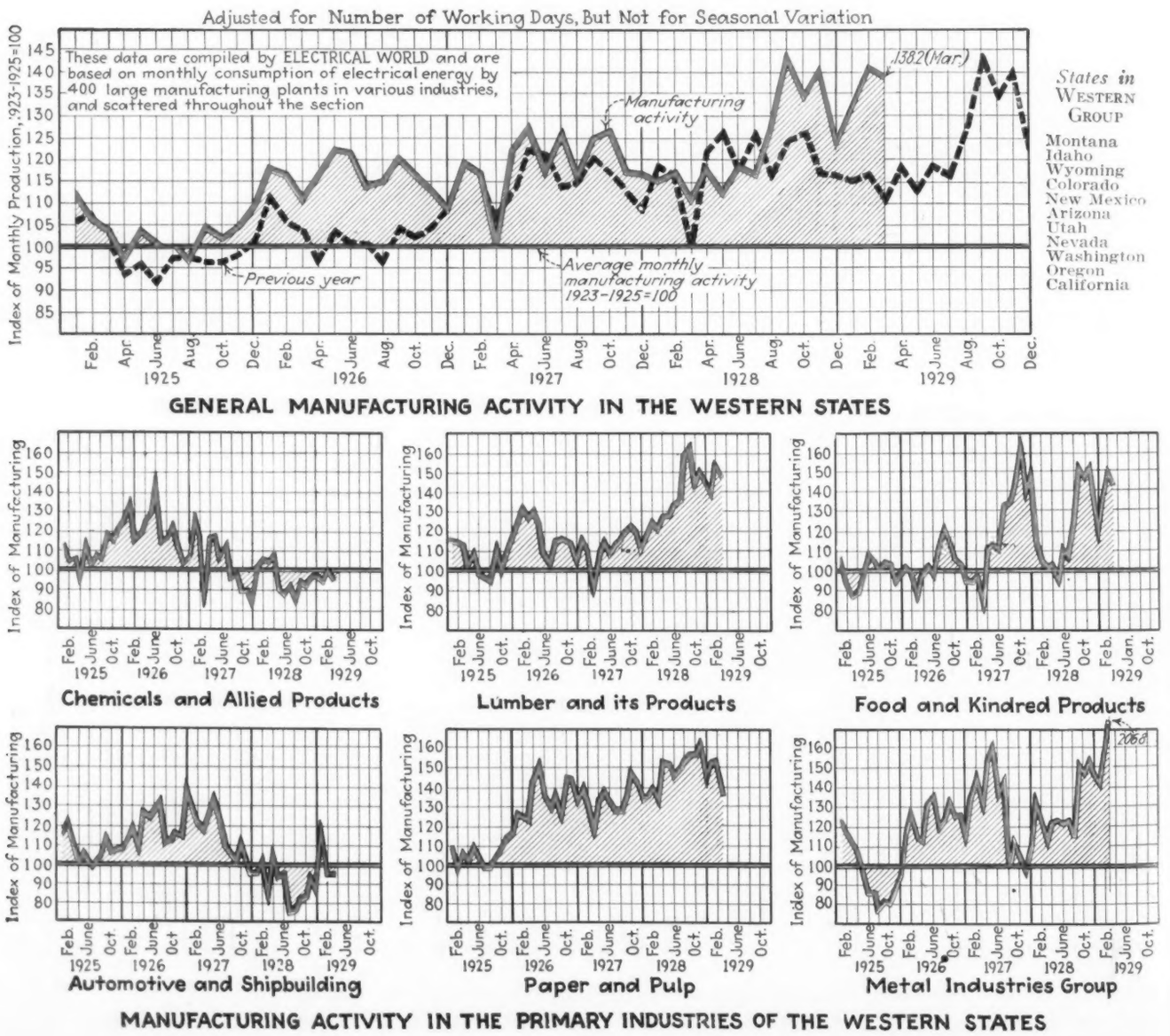
REPORTS received on the consumption of electrical energy by the manufacturing plants of the Western states indicate that the first quarter of the year witnessed the highest average rate of activity ever recorded by the manufacturing plants of the section. The average rate of operations for the past quarter was 19.7 per cent over the same period last year.

Operations in the section during March continued on a high plane. March activities were 1.7 per cent under February, slightly less than the normal seasonal decrease recorded in past years. As compared with March of last year, however, the current rate of activity showed an increase of 25 per cent. In the Western states March normally witnesses the lowest rate of activity for the year, hence there is every reason to believe that the coming months will witness an increased rate of activity notwithstanding the high rate of operations prevalent since the opening of the current year.

All of the industrial groups in the Western states with the exception of the metals group reported a drop in activity during March as compared with February. The chemicals group and the stone, clay and glass group are the only two industrial groups in the section reporting a rate of activity during March under that of March, 1928.

*Indexes of Industrial Activity in the Western States*

All Figures Adjusted for Number of Working Days

| | March, 1929 | February, 1929 | March, 1928 | Average First Three Months 1929 | Average First Three Months 1928 |
|---|---|---|---|---|---|
| All industry | 138.2 | 140.8 | 110.4 | 136.9 | 114.0 |
| Chemicals and allied products | 104.6 | 106.9 | 85.8 | 104.7 | 109.5 |
| Food and kindred products | 142.6 | 149.3 | 101.8 | 143.4 | 106.8 |
| Forest products | 147.2 | 153.0 | 122.0 | 146.2 | 121.8 |
| Metals group | 206.8 | 167.6 | 113.3 | 172.0 | 123.4 |
| Paper and pulp | 135.4 | 152.3 | 131.2 | 146.5 | 135.7 |
| Rubber and its products | 200.7 | 209.0 | 153.6 | 200.6 | 151.2 |
| Shipbuilding | 94.1 | 94.2 | 84.7 | 103.3 | 93.8 |
| Stone, clay and glass | 131.3 | 129.2 | 139.4 | 133.6 | 153.5 |

ELECTRICAL WORLD *Barometer of Industrial Activity in the Western States*